The New Zealand

Journal of Agriculture.

VOL. XX.—No. 6.

WELLINGTON, 21ST JUNE, 1920.

AN ECONOMIC INVESTIGATION OF THE MONTANE TUSSOCK-GRASSLAND OF NEW ZEALAND.

VII. ON THE EFFECT OF UNDERSTOCKING AND STOCKING TO ITS FULL CAPACITY A CERTAIN AREA.

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GENERAL.

THE area referred to in the title of this article is situated at about 2,000 ft. altitude on the long spur of Little Mount Peel, which descends to the Canterbury Plain. At the altitude mentioned an ordinary wire fence divides the tussock-grassland into two portions. For a considerable number of years the grassland on the one side of the fence has been treated differently from that on the other side with regard to the number of sheep depastured; otherwise the conditions to which the two areas are exposed are identical so far as light, heat, soil, slope, moisture, &c., are concerned—that is, if a narrow strip on both sides of the fence be alone considered. Here, then, occurs one of those rare but eagerly sought examples of vegetation where there is to be considered but one deciding factor regulating its structure in this case the relative amount of stock carried on the areas separated by the fence. That is to say, if these

areas of grassland had been exposed to identical sheep-grazing the plant-covering of both would have been exactly the same—just the same, indeed, as if no fence had existed.

Coming now to this deciding factor—the relative amount of stock depastured—the area above the fence, which is a part of the Mount Peel Station, has been stocked extremely lightly for a number of years. On the contrary, the area below the fence, under different management, has—I am given to understand—been stocked for a considerable time to, at any rate, its full capacity.

The differences in the vegetation on the two sides of the fence are so striking that the most casual observer could hardly fail to notice them. These differences can be plainly seen in Fig. 1, where a general view of part of the two areas is shown. But in this photograph the fence appears as the actual dividing-line, which is misleading. The true dividing-line is situated at a couple of feet or so from the fence on its upper side, and marks the farthest point to which sheep with their heads pushed through the fence can reach the herbage (see Fig. 2). This interesting fact confirms the information I received regarding the different degrees of grazing on the pasture of the opposite sides of the fence.

The Mount Peel Range differs a good deal from most of the other mountains abutting on the Canterbury Plain, insomuch as there are growing upon it certain species of a western character, which apparently require a rainfall higher than that of the ordinary eastern species of the Canterbury mountains. The continuous plant-covering of the subalpine portion of the range (see Fig. 3) also supports this view of the rainfall, as does likewise the taxad rain-forest which clothes some of the lower slopes, fills the gullies, and extends on to the plain. Little Mount Peel, one of the peaks of the range, attains a height of 4,200 ft. On its lower part it is clothed with rain-forest, or low tussock-grassland, as the case may be, and these are succeeded by tall tussock-grassland with a variety of the snow-grass (*Danthonia flavescens*) as the dominant tussock (see Fig. 3).

These few remarks on the general vegetation of the mountain are intended to pave the way for the special details next to be dealt with.

THE VEGETATION ON THE OPPOSITE SIDES OF THE FENCE.

Here, for sake of clearness, it is well to distinguish by name the vegetation, or pasture, on the one side of the fence from that on the other side, so that of the upper side will be denominated "lightly-grazed," and that of the lower side "heavily-grazed." But it must be remembered that these terms apply only to a girdle of not more than one chain in width on either side of the fence. This restriction is made not because the vegetation either below or above these limits changes appreciably, even for a considerable distance, but because the uniformity of the slope on either side of the fence changes, so that at a variable distance from the fence the conditions for the vegetation on either side are not identical; and in the conditions of the two areas under discussion being *identical*—save with regard to grazing—lies the crux of this article.

FIG. 1. GENERAL VIEW OF THE AREA ON LITTLE MOUNT PEEL.
On right of fence, the lightly grazed part; on left, the heavily grazed part.

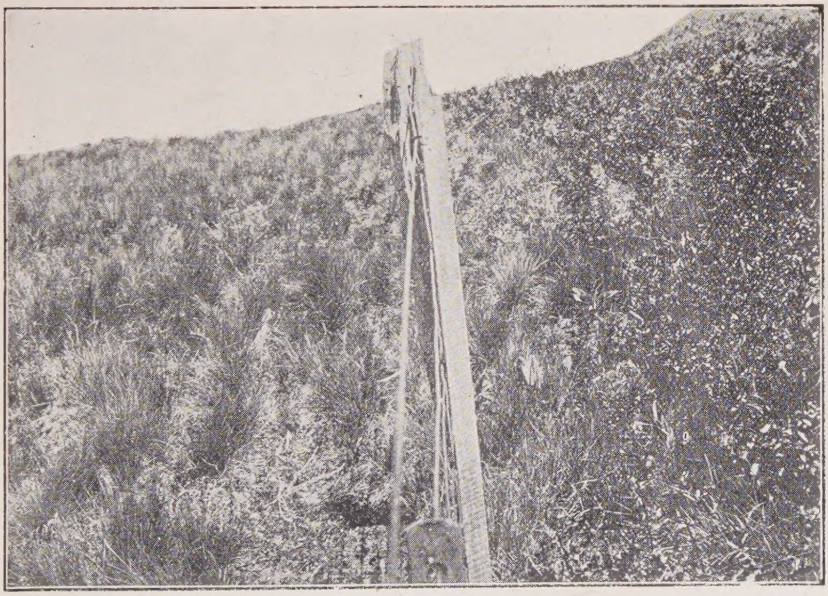


FIG. 2. CLOSE VIEW OF VEGETATION ON OPPOSITE SIDES OF THE FENCE.

Showing abundance of tutu on right (lightly grazed portion), and its absence on left (heavily grazed portion) and also as far as sheep can reach through to right of fence. [*Photos, W. D. Reid.*

Two main differences distinguish the lightly-grazed and heavily-grazed vegetation from each other. These are that, though nearly all the species which occur in the one occur also in the other, the lightly-grazed area possesses on its sunny slope abundance of tutu (*Coriaria sarmentosa* var.), which is absent on the heavily-grazed area; while on the more shady part of the lightly-grazed area there is abundance of the common cotton-plant (*Celmisia spectabilis*), which on the heavily-grazed area is absent generally, or, where it occurs, is far less common. These fundamental distinctions, as will be seen, can be directly traced to the grazing-conditions of the two areas.

The other distinctions between the lightly-grazed and heavily-grazed pastures consist chiefly of the larger size of the tussocks on the lightly-grazed area, of the smaller amount of bare ground, and of the larger quantity of palatable feed it contains. But such palatable species (*e.g.*, white clover, catsear, sorrel, hawksbeard, Yorkshire fog, and suckling-clover) occur upon both areas, so it is clear that spelling the heavily-grazed pasture would soon increase its palatability. This apparent greater palatability of the lightly-grazed pasture is considerably reduced, however, through the amount of ground taken up by the cotton-plant and mountain-flax (here grassland "weeds"), as also by the larger amount it contains of bracken-fern (*Pteridium esculentum*), a plant of very low palatability.

On the more shady part of the lightly-grazed area, in addition to the common cotton-plant, there is a good deal of mountain-flax (*Phormium Colensoi*) (see Fig. 5). Sometimes the cotton-plant comes up close to the fence-line, but does not extend on to the heavily-grazed area (see Fig. 6); but in places there is a small amount of this plant and also of the mountain-flax on the heavily-grazed area.

Remarks concerning Tutu.

Something must be said about the tutu (*Coriaria sarmentosa* var.), as its occurrence in quantity under extremely light grazing on the one hand, and its absence under heavy stocking of the pasture on the other hand, is the most important fact of this article.

The Mount Peel plant is that variety—as yet unnamed, unless it be *Coriaria tutu* of Lindsay—of the species the shoots of which lie down to the ground at the close of the floral year and are renewed in the spring. Below ground, but not far from the surface, there is a stout far-spreading underground stem, by means of which a plant may occupy a considerable area, so that fresh soil is ever at its disposal, while for its increase it is more or less independent of seeds. It is thus a plant capable of great aggression. This herbaceous or semi-woody summer-green form is, on the one hand, included botanically with the well-known shrub form or tree form of the forest; but, on the other hand, there is a remarkable gradation of forms connecting it with the smaller-leaved species, *Coriaria thymifolia*, while the latter similarly grades into the fine-leaved alpine tutu (*Coriaria angustissima*).

This multiplicity of forms can most likely be attributed to there being a number of tree-breeding races of tutu which readily cross one with the other. Be this as it may, the matter which specially concerns this article is that, so far as is known, all the forms of tutu contain in

FIG. 3. TALL TUSSOCK-GRASSLAND OF LITTLE MOUNT PEEL AT 2,320 FT. ALTITUDE.

Showing abundance of snow-grass (*Danthonia flavescens*), between which can be seen the leaves in rosettes of the common cotton-plant (*Celmisia spectabilis*).

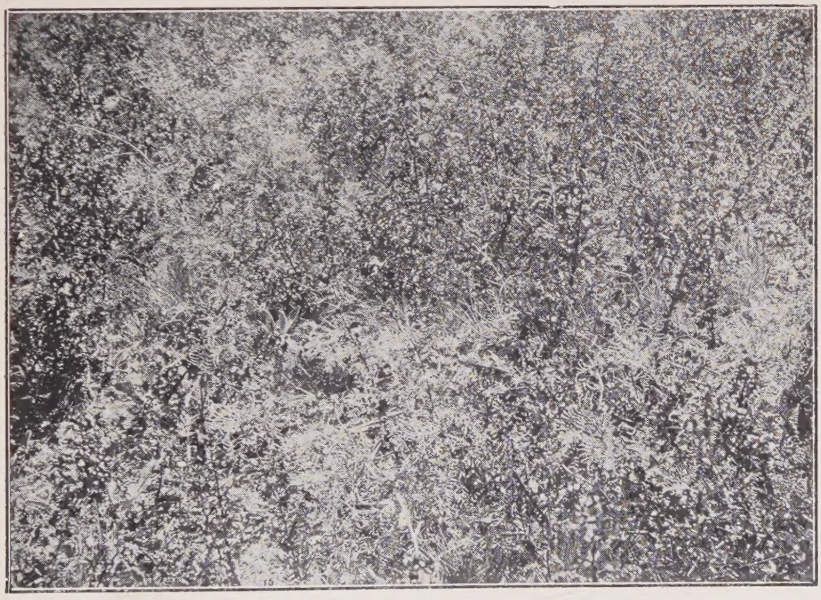


FIG. 4. VIEW OF SOME OF THE LIGHTLY GRAZED VEGETATION, SHOWING THE ABUNDANCE OF TUTU.

Tussocks and some bracken-fern can also be seen.

[*Photos, W. D. Reid.*

their stems, leaves, and seeds a glucoside poison named "tutin," and that sheep have died through eating one or other of the kinds of tutin. Whether all the forms of this polymorphic species and its equally polymorphic allies are equally poisonous has not yet been ascertained. Easterfield and Aston, the discoverers of tutin, in 1901 investigated material of all three species, but at that time the idea of there being a number of distinct races had not been put forth. Theoretically, as stated already, there should be such, and it is highly improbable that all are equally poisonous. Before such a chemical problem can be attacked it is necessary to searchingly investigate the composition of the various forms of tutu from the botanical standpoint. Such work would have an obvious economic bearing. But it could not be solved by ordinary taxonomic methods; breeding-experiments would be essential.

The question as to the difference between the lightly-grazed and heavily-grazed pastures in their tutu-content seems easy to answer. The key to its solution is that small piece of ground already mentioned, 2 ft. or so across, bordering the fence on the lightly-grazed side. On this narrow strip, which is grazed just as freely as the heavily-grazed area, and is really a part of it, there are only solitary plants of tutu at long distances from one another, and all these at the time of my visit in November, 1919, gave signs of being freely eaten. Could the sheep reach farther into this lightly-grazed pasture the tutu would be doomed up to the point they could gain In other words, sheep appear to feed upon it freely, even during the spring, when the young succulent shoots are supposed to be especially poisonous.

Can it be, after all, that tutu is a sheep-feed of high palatability? Many sheep-farmers have told me that sheep living where tutu abounds eat it with impunity. The general opinion is that it is poisonous for travelling sheep, or for those unaccustomed to it if suddenly turned on to pasture where it is in plenty. Evidently under heavy stocking it cannot persist, or it would occur equally on both sides of the fence, as do those palatable grasses and other plants which are of medium palatability or are able to tolerate severe grazing. It is quite unexpected that a plant so admirably adapted to extend its area of occupation at the expense of the neighbouring plants by means of its rapid vegetative increase, and equally rapid growth in the spring, should succumb to the attacks of sheep, but its degree of palatability and its herbaceous habit bring about its downfall. On the other hand, its subterranean parts, rich in stored-up food, render it immune to grassland fires, which, rather than damage the plant, encourage its spread.

The Cotton-plant, Mountain-flax, and Poa-tussock.

The common cotton-plant (*Celmisia spectabilis*) stands in a different category to the tutu. It is unpalatable. It, like the tutu, can defy the fire, but this not because it has an underground-stem system, but because the dead leaf-sheaths persist for many years and surround the bud—the vital part of this plant—with a thick protection of wet, half-decayed material. But why does this plant die out under heavy grazing? This is apparently does—and an excellent thing, too, to be rid of a pasture-weed. Perhaps the explanation is that, after burning, the trampling of sheep destroys the bud; also, they may

FIG. 5. VIEW IN THE LIGHTLY STOCKED AREA ON SHADY SIDE, SHOWING A GOOD DEAL OF MOUNTAIN-FLAX.

On far side of fence is part of the heavily grazed area.

FIG. 6. VIEW OF BOTH AREAS NEAR SUMMIT OF THE RIDGE.

On left (lightly grazed), the cotton-plant coming close to fence; on right (heavily grazed), only poa-tussock and fescue-tussock in evidence.

[*Photos, W. D. Reid.*

eat the young leaves. In favour of this view is the fact that on rocky ground to which sheep have not access the plant remains intact, as it also does on stony spurs not readily reached by fire.

The absence of the mountain-flax (*Phormium Colensoi*) on the lightly-grazed ground may also be attributed to burning, but in its case the young leaves—its vital part—are eaten, and the plant is eventually killed in this manner.

Apparently in the lightly-grazed area there are more tussocks of the poa-tussock (*Poa caespitosa*) than on the heavily-grazed area; they are also greener in colour than those of the fescue-tussock, thus in places giving another special character to the lightly-grazed grass-land. This difference in the amount of the poa-tussock on the

FIG. 7. VIEW OF SMALL PIECE OF THE HEAVILY GRAZED PASTURE.
The tussocks are mostly fescue-tussock. [*Photo, W. D. Reid.*.

opposite sides of the fence under apparently the same conditions, except those of grazing, I cannot explain. If the ground were slightly wetter on the slightly-grazed area the poa-tussock would be favoured. At any rate, the differences in the grazing cannot be of any moment in the case of so unpalatable a species. More frequent burning on the heavily-grazed area would also assist in reducing the amount of poa-tussock, but a wire fence should not arrest a grass-fire.

SUMMARY AND CONCLUSIONS.

1. At an altitude of about 2,000 ft. on Little Mount Peel a wire fence separates an area of extremely lightly grazed pasture from an area of fairly heavily grazed pasture, but the other conditions affecting the composition of the pasture of the two areas are identical.

2. The two pastures are, at first glance, to be distinguished by their entirely different appearance, and this has been brought about by the difference in intensity of the grazing to which these two pastures respectively have been exposed.

3. The differences in the physiognomy of the two pastures is due to the heavily-grazed pasture being of the ordinary low tussock-grassland type (see Fig. 7), whereas in the lightly-grazed pasture there are large quantities of tutu on the sunny slope and of common cotton-plant and mountain-flax on the more shady slope.

4. There is no tutu and very little common cotton-plant or mountain-flax on the heavily-grazed pasture.

5. Also, for a distance of some 2 ft. from the dividing-fence on the lightly-grazed area—*i.e.*, to a line marking the extreme limit sheep feeding through the fence can reach—the tutu has been eaten out except for a solitary plant or two, and these have been eaten freely.

6. From these data it appears that on pasture heavily grazed by sheep tutu cannot maintain itself.

7. Apparently sheep brought up on land where tutu is abundant can eat it with impunity, even in spring.

8. Tutu appears to possess a high degree of palatability for sheep.

9. By means of heavy stocking it appears as if tutu could be eradicated.

10. Tutu is destroyed through grazing by its leafy shoots not being allowed to develop; otherwise, through its power of rapid increase by means of its spreading underground stems, it can become extremely abundant, even in pasture which is regularly burned.

11. The absence of common cotton-plant and mountain-flax in the heavily-grazed pasture may be attributed to the young leaves which appear after burning being destroyed by the sheep.

Herb-culture.—In the herb-garden at Arataki Horticultural Station 4 bushels of stramonium-seed was recently harvested. A small quantity of henbane-seed was also saved. Belladonna has been sown again for further trial.

Lucerne and Inoculated Soil.—The Fields Supervisor, Christchurch (Mr. A. Macpherson), reports: "In South Canterbury many areas sown to lucerne have lately been inspected, and quite a number which are not thriving show on digging down and examination of the roots that there are no nitrogen-gathering bacteria or nodules on the roots, although these lands grow clovers well. Apparently the bacteria necessary for successful lucerne-production are not present in the soil, and until growers make provision for this lack by sowing soil taken from an inoculated area their experience in lucerne-growing will not be satisfactory."

DAILY VARIATIONS IN MILK-TEST.

SOME DATA FROM CERTIFICATE-OF-RECORD WORK.

W. M. SINGLETON, Assistant Director of the Dairy Division.

EVER since the inception of the factory system of manufacturing cheese and butter the yield from the milk supplied by individual dairymen has received more or less attention. In the earlier days, when payment was made on quantity alone, tests to disclose possible adulteration were in vogue, and this system prevailed generally until the introduction of the Babcock test. The general use of this test in New Zealand has superseded the earlier tests for adulteration. It has been found that to add water does not increase the payment from the factory. No system seems to be inseparable from irritating factors. Although payment for milk on the butterfat basis is generally recognized to be the best yet devised, the human element must be introduced in making the tests. The work has therefore sometimes been questioned by suppliers receiving a comparatively low test. While carelessness in the testing may justify some of these complaints, the larger proportion of the dissatisfaction is probably due to causes arising from the cows and not to the factory testing.

EQUAL DAILY MILK-YIELD WITH VARYING TESTS.

In the course of the certificate-of-record work carried out by the Dairy Division we have collected data from testing the samples of two consecutive days separately. These purebred cows are, as a class, better cared for than the individuals of an average dairy herd. Milking-hours are more regular, and care is taken in many cases to guard against such cows becoming nervously upset. Despite such precautions the variations in percentages of fat from day to day were sometimes found to be extraordinary. When the weight of milk does not vary from day to day a cow might be expected to be in a uniform state of health, and her milk uniform in quality. This may be the rule, but, if so, the following exceptions have been authenticated by our officers :—

First Day.		Second Day.		Difference.	
Milk, in Pounds.	Fat, Percentage.	Milk, in Pounds.	Fat, Percentage.	Milk, in Pounds.	Fat, Percentage.
24·0	6·1	24·0	4·4	0·0	1·7
26·9	7·3	26·9	6·1	0·0	1·2
34·5	5·8	34·5	7·0	0·0	1·2
18·9	8·1	18·7	6·3	0·2	1·8
39·8	4·2	39·5	5·8	0·3	1·6

DAILY MILK-YIELD NOT AN INDEX OF THE TEST.

Dairymen and breeders frequently assume that if the weight of milk shows a decrease for the day the percentage of butterfat must show an increase. It is assumed on this reasoning that the cow secretes a practically uniform weight of butterfat each consecutive day, although this may increase or decrease over a period. If the decrease in test be due to other than shortage of feed this reasoning appears to be unsound. If cows are in good condition, and feed be restricted for a time, the expected result may occur. If the cow is in very low condition probably the test is also below normal. The examples following show that cows on certificate-of-record test—not short of feed or in low condition—may evidence a decrease in their daily milk-weight and also a decrease in the percentage of fat as compared with the preceding or following day. Authenticated figures bearing out this contention are,—

First Day.		Second Day.		Difference.	
Milk, in Pounds.	Fat, Percentage.	Milk, in Pounds.	Fat, Percentage.	Milk, in Pounds.	Fat, Percentage.
51·8	5·0	40·9	2·6	10·9	2·4
20·6	7·6	18·1	6·1	2·5	1·5
31·4	7·3	29·1	5·7	2·3	1·6
31·8	5·3	27·8	4·8	4·0	0·5
32·8	4·3	27·4	3·1	5·4	1·2

When a cow is producing her maximum milk-yield for the day may we not assume she is feeling particularly well? If a cow is in the best of health it should not be unreasonable to expect an increase in percentage of butterfat as well as in weight of milk. Judging from figures from certificate-of-record data tabulated below, it would appear that in such circumstances an increase in butterfat percentage is not unlikely. This recalls a statement of Dr. Babcock's to the effect that cows going from stable-feed to pasture-grass in the North American spring-time are inclined to increase both in milk-yield and percentage of butterfat. The following are the figures confirming the suggestion made as to such increases :—

First Day.		Second Day.		Difference.	
Milk, in Pounds.	Fat, Percentage.	Milk, in Pounds.	Fat, Percentage.	Milk, in Pounds.	Fat, Percentage.
21·6	4·4	23·6	6·6	2·0	2·2
28·2	4·7	32·0	5·8	3·8	1·1
38·9	3·3	43·0	4·1	4·1	0·8
36·0	4·5	37·9	5·3	1·9	0·8

MENSTRUATION PERIOD.

The effect on the daily yield of milk and percentage of butterfat of the cow coming "in season" is difficult to forecast. Some cows appear to vary but little, if any; others may evidence a decrease in

milk-yield, but the test may be unaffected; while others, again, may show a normal milk-yield with a decrease in percentage of butterfat. The variations may include both milk and test. When such is the case the milk usually evidences a decrease more or less marked, and the butterfat percentages are in many instances inclined to evidence a decrease as well. The following figures represent variations at the period in question :—

Normal.		In Season.		Difference.	
Milk, in Pounds.	Fat, Percentage.	Milk, in Pounds.	Fat, Percentage.	Milk, in Pounds.	Fat, Percentage.
28·5	6·2	29·5	6·2	1·0	0·0
42·3	3·4	37·5	3·4	4·8	0·0
20·1	5·8	20·0	4·6	0·1	1·2
31·3	5·8	11·8	4·3	19·5	1·5
41·4	3·5	33·6	2·6	7·8	0·9

CHANGE OF MILKERS.

It seems to be well known that any influence which affects the cow in a manner which she dislikes will be reflected in her production. So long as the writer can remember it has been advocated that cows should, as far as possible, have the same milker at each milking. Some cows are affected very materially, while others are not so discriminating. When a variation is caused by a change of milker it is generally at the expense of the owner, the new milker usually getting poorer results. An eminent authority has stated that to get the best results from a cow the milker must take the place of the calf in the cow's affections. The evidence certainly points to the conclusion that the cow prefers old friends. Our data in this connection are, in part, as follow :—

Regular Milker.		New Milker.		Difference.	
Milk, in Pounds.	Fat, Percentage.	Milk, in Pounds.	Fat, Percentage.	Milk, in Pounds.	Fat, Percentage.
29·6	6·5	26·9	4·1	2·7	2·4
28·7	6·3	26·3	4·9	2·4	1·4

CONCLUSION.

The work carried out by the testing officers of the Dairy Division emphasizes the fact that variations occur in the butterfat percentage of a cow's milk from day to day to a degree many would not have thought possible.

The comparative quantity of milk given for the day cannot be taken as an index of the test in every case, as our figures show that when the milk-weight evidences an increase the test may show either an increase or a decrease or remain normal. Although cows when in season are more likely to yield a smaller quantity of milk than to give an increased flow, many cows vary little in this respect. The test

for the smaller yield of milk may remain normal or vary from the normal in either direction. A change of milker seems to carry with it, as a rule, a penalty by way of a decrease in milk-weight, and in many instances a reduction in the test as well.

The foregoing information is put forward with a view to assuring dairymen and breeders that when variations occur in tests for butter-fat it should not be immediately assumed that the variation is due to carelessness, lack of ability, or malice on the part of the person conducting the test.

LIME-REQUIREMENT OF NEW ZEALAND SOILS AND LIME-DEVELOPMENT.

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

In June of last year* it was decided by the Department, in view of the great value of lime as an improver of New Zealand soils, that steps by means of soil-testing under special conditions should be taken to bring home to farmers the necessity for liberally liming their lands in order to get the best results. Supplies of limestone of high quality are well distributed throughout the Dominion. A recent bulletin (Geological Survey No. 22, New Series), prepared by Mr. P. G. Morgan, Director, and other officers of the Geological Survey (which can be obtained from the Geological Survey Office, price 7s. 6d.), summarizes the extent of our knowledge concerning these deposits. There is therefore no insuperable difficulty in obtaining lime-supplies, the position being essentially different from that of phosphate-supplies, which cannot, so far as we know at present, be obtained in New Zealand in sufficient quantities to meet the demand, and therefore have to be imported.

The difficulties in connection with making available the limestone-supplies of the Dominion appear to fall into three categories. Firstly, since the high-grade deposits, ranging from 75 to 95 per cent., are so well distributed, it would, as a rule, be obviously bad policy to work the low-grade deposits, containing, say, anything from 40 to 75 per cent., except for a very limited area near the deposit or under very special circumstances. The cost of bagging, handling, and haulage of, say, 50 per cent. of inert matter is a great consideration when hundreds of tons are dealt with. Nevertheless, conditions do exist where soft limestone of low-grade occurs in which the carbonate of lime is intimately mixed with siliceous and clayey matter, and weathers down on the land to such a fine powder that in practice it has paid to use some thousands of tons of this material, which has been sieved, bagged, and carried by rail and cart over a considerable area of country.

Every case of lime-development must be considered on its merits with a full knowledge of local conditions, and those considering it should work with a local farmers' committee. Firstly, the Chemist to the

* See notice on page 331 of the *Journal* for June, 1919, which is brought up to date and reprinted at the end of this article.

Department will receive samples of alleged limestone collected from a district by farmers or Fields officers. These samples should include not only samples of limestone, but also typical soils of the district, in order to ascertain in what proportion lime is required and over what areas. The collection of the soil-samples should be left entirely with the Instructors and their assistants, as they are provided with the proper apparatus for collecting the soils, and have the requisite expert knowledge to enable them to form a better opinion as to the types of soil which exist and how to sample them. Secondly, the Chemist and his staff having selected certain deposits as suitable chemically, and determined by tests on typical soils that lime is necessary, the Geological Survey, having at its disposal several alternative sites for quarry, grinding-works, or kilns, which have been selected by those having local knowledge, makes a final selection after an examination as to the quantity of stone available and other considerations. Thirdly, the engineer is necessary in advising the best methods of obtaining and reducing the stone, or burning it, and of conveying it to the lands on which it is to be used.

It is not intended to imply that these officers are necessarily to act in the order named, or that one is more needed than another. What is aimed at is that they shall, as far as possible, act in full sympathetic concert, in order to do the best they can for the farmer and producer in making available the vast supplies of limestone at present needed by the soil. To this end it was decided to refer all inquiries and questions relating to lime-supplies to a committee consisting of the Chemist to the Department of Agriculture (convener), the Director of the Geological Survey, and the Assistant Engineer-in-Chief of the Public Works Department, as notified on page 155 of the March, 1920, issue of the *Journal*.

During the past year the Fields officers of the Department of Agriculture have been actively engaged in drawing samples of soil from various localities in their respective districts. They were instructed to select samples from lands which their judgment would lead them to suppose were typical, and to avoid mixing unlike types of soil, the general aim being to benefit as many farmers as possible through the means of each sample. Hence the instructions were to collect a few samples of representative soils rather than a larger number which only represented limited areas.

From the figures tabulated below some idea may be gathered as to the great need of New Zealand soils for lime. The method used is that of Hutchinson and MacLennan, Rothamsted Laboratory (see *Journal of Agricultural Science*, Cambridge, March, 1915). This method gives very high figures for humus or peaty soils—so much so that impracticable amounts of limestone are thereby indicated as necessary. Further, these areas occupy such a small proportion of the lands of New Zealand that they have been neglected in computing the averages. Probably humus or peaty areas will be dealt with best by some other method than attempting to satisfy the lime-requirement as indicated by the Rothamsted method, since to apply anything like 10 to 12 tons per acre to a soil is not possible under ordinary present conditions. Possibly some method of burning the top soil might prove preferable. (For an example see the account of experiments in the Waikato district, "Development of Peat Swamps," by Reynolds and Aston, this *Journal*, July, 1917.)

In considering the following table it should be borne in mind that it is quite tentative in character. It merely indicates, as an average, the net result of each Instructor's work for the year. The figures are published with a view to letting the public know that this work is steadily going forward, but that progress is necessarily slow, and reliable generalizations as to the average requirement of any one district can only be arrived at after many more samples have been collected and tested.

Number of Samples collected.	District.	Average Tons of Carbonate of Lime required per Acre.
70	Auckland	3·8
24	Wellington	1·8
6	Taranaki	2·3
8	Hawke's Bay	2·0
9	West Coast, South Island ..	4·9
14	Canterbury	1·3
16	Otago and Southland	2·3

TESTING FOR LIME-REQUIREMENT: NOTICE TO FARMERS.

In view of the great importance of lime on New Zealand soils, the present shortage of phosphates, and the fact that the use of phosphates may be economized by the application of lime, the Department will examine any soils which are properly collected by a Fields Instruction officer, for the purpose of determining the amount of lime which such soils actually require.

For this purpose it is desirable that groups of farmers, such as those forming the local branches of the Farmers' Union, or other farmers' organizations, should approach any one of the following Fields officers, and get him to appoint a date for visiting their district and for collecting typical soils for testing: Mr. T. H. Patterson, Instructor in Agriculture, Auckland; Mr. J. W. Deem, Fields Instructor, Wanganui (for Taranaki, Manawatu, and Hawke's Bay); Mr. F. E. Ward, Instructor in Agriculture, Wellington (for Wairarapa, Hutt Valley, Nelson, and Marlborough); Mr. A. Macpherson, Fields Instructor, Christchurch; Mr. R. P. Connell, Instructor in Agriculture, Dunedin; Mr. W. Alexander, Fields Instructor, Invercargill; Mr. C. S. Dalgliesh, Fields Instructor, Hokitika.

Farmers will note that—(1.) It is essential that the samples should be collected by an officer who has been specially instructed in the correct methods of soil-sampling, in order that the results of the test may be dependable. (2.) The testing of these samples, in order that it may be expeditiously performed, must be limited to the question of what amounts of lime are required per acre.

Limestones.—Samples of limestone from various localities recently tested by the Chemistry Section gave the following percentages of carbonate of lime: Seddonville, 61; Remuera, 97, 90, 88, 78; Maungaturoto, 71, 76; Longbush (Carterton), 90, 88, 94, 91, 97, 59; Port Albert, 76, 82, 57, 71, 60, 96, 75, 85, 72.

COCCIDIOSIS OF POULTRY.

LOCAL OCCURRENCE AMONG TURKEYS.

H. A. REID, F.R.C.V.S., D.V.H., F.R.S.E., Officer in Charge, Veterinary Laboratory, Wallaceville.

WITHIN the past few weeks cases of disease among turkeys in the North Island have come under the notice of the writer. Specimens of the viscera of a young turkey were forwarded to the Wallaceville Laboratory with a report stating that numerous deaths had occurred, and requesting that an investigation be undertaken with a view to determining the cause. The nature of the specimens submitted proving not altogether satisfactory, a carcase of one of the dead turkeys, and later a live bird showing symptoms of the disease, were obtained.

In an accompanying letter the owner supplied the following information regarding these cases: "The turkeys have been kept in this place for only about twenty months. No turkeys were kept here for many years, perhaps never before. The situation is high and dry, on a hilltop. The birds have plenty of ideal shelter—trees and shrubs—are never penned, and can wander as far as they like. There have been only small numbers of other poultry kept, with no trace of sickness. The turkeys were brought from ——, two hens and a cock to start—strong healthy-looking birds. Almost immediately after arrival the cock showed symptoms of sickness—going off food, drooping, and passing the always present bright-yellow-coloured excreta. Although this bird went very low he recovered quickly, and has been strong and thriving ever since. There has been no sign whatever of any other disease, and no trouble in rearing the young ones, the so-called critical periods being passed without the least trouble. The birds are generally well grown before the trouble starts, and strong and heavy. Sometimes the birds after a long illness recover. I have noticed that in periods of wet weather the disease progresses more rapidly. I feel certain that the disease was in the cock bird before he came here. The hens I got with him never showed it. I do not know, but I think, that it does not affect birds after two years old."

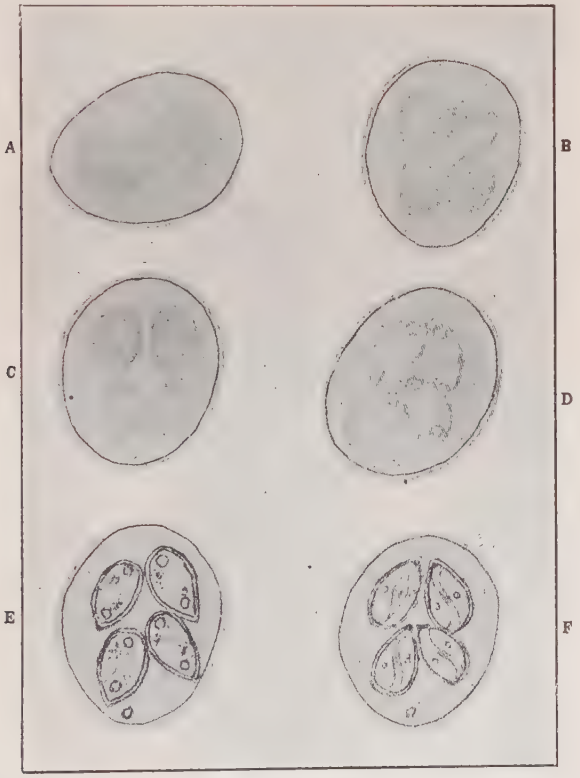
My informant states that the disease assumed virulent proportions on a neighbouring property, when twenty to thirty turkey chicks all died at about two weeks old. Those that were opened showed liver conditions exactly the same as the older birds—namely, spotted yellow. The first signs of the disease are a mopey appearance, and the invariable presence of yellow droppings. A little later the affected birds get an anæmic colour, and lose weight rapidly, though always strong weighty birds to start with. "The change for the better comes about suddenly, provided conditions are favourable. These include fine weather, good feeding, and attention. Under other conditions the birds seem to die in a short time."

Investigation led to the discovery that the trouble was due to coccidiosis. This disease is set up by a minute animal parasite—*Eimeria*

avium—belonging to the group of protozoa known as sporozoa. These organisms invade the digestive organs of the infected birds, producing lesions which frequently result in serious mortality.

LIFE-HISTORY OF THE PARASITE.

The life-history of the sporozoa is complex, and a short account may be of interest to some readers. These parasites are capable of passing both sexual and asexual stages of existence. As seen by microscopical observations of preparations made from the excreta of diseased birds, they appear as ovoid cysts filled with granular contents within a transparent membrane or shell, which under a sufficiently high power of magnification is seen to possess a double-contoured outline. This is the so-called oocyst stage, a resistant form which for a time inhabits



OOCYSTS FROM CHICKEN, AFTER INCUBATION AT 75° TO 80° F.
(Drawing not to scale.)

At A, after forty-eight hours. At B four sporoblasts are shown within the oocyst. C and D, after seventy-two hours, showing further developmental stages of sporoblasts. E and F, after the fourth day at 75° to 80° F. Sporocysts with double-contoured resistant coverings lying within the oocyst. At F, each sporocyst contains two sporozoites and some residual matter.

[*After Jowett, in Journal of Comparative Pathology.*

the cells lining the mucous membrane of the bowel, into which it had penetrated at a former stage of existence.

The oocyst escapes with the excrement; and outside the body, under certain favourable conditions of temperature and humidity, it commences to undergo further changes. Should the necessary conditions for further development not be met with the oocyst can remain dormant, protected by its strong shell, until a more favourable opportunity arrives. It has been estimated that these bodies are able to resist destruction from natural processes for months, and even as long as two years, this vital property constituting one of the most difficult features in combating the disease.

Given the necessary factors for its development, the contents of the oocyst undergo differentiation into four spherules called sporoblasts. Each sporoblast in its turn undergoes changes to become a sporocyst, and now appears as miniature oocysts, each surrounded with a double-contoured membrane lying within the larger parent cell. Each sporocyst now divides into several sporozoites. The original oocyst containing the sporozoites, being taken in by the bird with its food or water, is introduced afresh into the bowel, where, by the process of digestion, it ruptures, setting free the sporozoites.

These sporozoites are capable of moving freely; they fix themselves to the cells lining the intestine, and finally penetrate them. The sporozoite grows at the expense of the invaded cell, and undergoes gradual transformation into a number of minute bodies known as merozoites. The cell ruptures and liberates the merozoites. These in turn penetrate other intestinal cells of the host, and by a process of division form new merozoites. The newly formed merozoites, after penetration of fresh cells, may in some instances become female elements (macrogametes), and in others male elements (microgametes). The macrogamete is fertilized by union with a microgamete, and the fertilized cell then gradually develops into an oocyst—to recommence the cycle.

OTHER FACTS.

Some authorities (Theobald Smith, Cole and Hadley, Hadley and Amison, and Jowett) describe an organism which they consider to be responsible for the disease commonly known as "blackhead" in turkeys. This organism was named by Smith the *Amoeba meleagridis*, and Jowett considers it to represent a "stage in the life-cycle of a flagellate, in all probability a trichomonad, present in the intestinal contents of the bird.* The parasite described in Jowett's article was also seen to be present in the cases under review. No amœboid movements, however, could be observed; and in view of the presence of very numerous coccidia it was considered that one either had to deal with a mixed infection, or that, as held by some, the *Amoeba meleagridis* merely represents a stage in the development of a coccidium. The opinion that coccidia are responsible for this infection also finds support from H. Gray in an article on the subject of coccidiosis published in 1913.† Blackhead, it should be remarked, appears to be a rather unfortunate

* "Blackhead: Infectious Entero-hepatitis or Typhlo-hepatitis—a Disease of Young Turkeys," by Walter Jowett. *Jour. Comp. Pathology*, 1911.

† "Coccidiosis of Birds," by H. Gray. Published in "A System of Veterinary Medicine," Vol. 1.

popular term used to describe this disease affecting turkeys. This symptom is by no means constant, and nothing like the density of colour implied by the term was observed in any of the cases examined by the writer.

It has been noted by certain investigators (Cooper Curtice in America, and Jowett in Cape Colony) that chickens may harbour the parasite (*Amoeba meleagridis*) without showing symptoms of disease, and that they may act as disseminators to the more susceptible turkeys with which they may come in contact. It is considered inadvisable, therefore, to attempt to farm fowls and turkeys on the same ground; at any rate, if possible, the young turkeys should not be allowed to mingle with other poultry.

The disease in birds is known under the terms spotted liver, blackhead, dysentery, and more technically as infectious entero-hepatitis. The first account of this disease is ascribed to Rivolta, who in Italy, in 1878, reported its occurrence among domesticated and wild birds. More recently the disease has been recorded by various investigators, among whom may be mentioned McFadyean, Moore, Cooper Curtice, Raillet, and Jowett. Jowett, in an article published in 1911, reports the disease as occurring in Cape Colony, where it is responsible for heavy losses among poultry, as many as 60 or 70 per cent. of young chicks dying from this infection.* According to the findings of a commission appointed some years ago to inquire into the mortality of grouse in Scotland, coccidia were implicated in producing the greatest fatality among grouse chicks.

CONTAGION.

Among poultry coccidiosis is usually set up by the introduction of a newly purchased bird harbouring the parasite. Soiled eggs, or eggs which may actually contain the parasite, are also responsible in some cases for conveying the disease. Old crates, second-hand fowl-houses, and incubators are also fruitful sources of contagion. In New Zealand rabbits are frequently infested by coccidia, and it has been suggested that these are capable of setting up infection in birds. The evidence on this point is very doubtful. As a rule, parasites, even of the same species though differing in variety, are incapable of producing disease in animals of species other than their normal hosts. In this respect they are strictly selective, and will only multiply in the particular host to which they belong.

Coccidiosis, so far as I am aware, has not hitherto been recorded as occurring among birds in New Zealand, though it may be pretty widely distributed. There is a general opinion in this country that turkeys are most difficult to rear. Quite apart from the loss inflicted by stoats, weasels, and hawks, deaths among the younger birds are of frequent occurrence. The disease may occasion heavy loss among chickens and fowls, though, so far, it has not come under the observation of the writer. The possibility of its presence, however, should not be overlooked whenever mortality occurs amongst birds of any species, especially if any of the characteristic symptoms are in evidence.

* "Coccidiosis of the Fowl and Calf," by W. Jowett, Department of Agriculture, Cape Town. *Jour. Comp. Pathology*, 1911.

SYMPTOMS.

As regards the symptoms, there is little necessity to amplify what has been related in the opening paragraphs of this article. In chickens a few days old the disease assumes very virulent proportions. The chicks stop feeding, cry incessantly, and move about restlessly. The colour fades from the comb or beak, and they soon die. At this early age the symptoms of diarrhœa, which characterize the disease among older birds, may be altogether absent. In older chickens and young turkeys the birds appear to mope and waste away. The droppings are of a chalky appearance, gradually changing to bright yellow, and becoming more fluid in consistence. In the later stages they are mixed with blood and mucus. The comb and wattles of poultry, and the featherless parts of the heads in turkeys, lose their bright hue, becoming leaden or almost blackish in colour. The sick birds may appear bright about the eye until within a few hours of death. On removal of the feathers the carcase is seen to have been reduced to mere skin and bone.

Turkeys between the ages of three weeks to three months appear more susceptible to attack. The mortality is heavy, but some of the affected birds may recover. The recovered birds may harbour oocysts for a considerable time after their apparent return to health, and may convey the disease on to fresh pastures and fatally infect younger or more susceptible subjects.

It is stated that the coccidia may be present in the albumen of eggs derived from affected hens, the parasite gaining access before the egg reaches the shell-forming portion of the oviduct. Such instances may account for the mortality among brooder-reared chicks, when other means of infection are remote or cannot be accounted for.

POST-MORTEM APPEARANCE.

On opening the carcase of a bird dead of this complaint the belly cavity is found sometimes to contain a quantity of blood-stained serous exudate, which may cause adhesions to form between the various organs in this situation. The most striking feature is the changed appearance of the liver. This organ is generally enlarged and much congested. Upon its surface appears circumscribed patches varying in size from a pea to a sixpence. Occasionally these patches may have become confluent, forming an irregular discoloration upon the surface. These areas are of a darker colour than the surrounding liver-tissue, and very often present a yellowish centre. Sometimes the patches are of a uniformly yellow tint. Thev involve to a very slight extent only the depths of the liver-tissue.

The intestines are filled with yellowish or yellowish-green fæces mixed with mucus. In some cases numerous stones and pebbles are found in the lumen of the bowel. The cæca, or blind guts, are markedly altered in appearance. They are congested, and the walls of one or other are very much thickened. The interior is filled with cheesy blood-stained concretion adhering to the mucous surface of the bowel.

Microscopically, the blood of affected birds shows a very well-marked and characteristic increase in the number of certain of the white blood-cells—the eosinophile leucocytes. This appearance of the blood is common to most parasitic infections, and forms a useful guide in cases of parasitic disease.

Microscopic examination of preparations made from the droppings or contents of the bowel shows the presence of numerous oocysts in varying stages of development. Similar examination of the diseased bowels shows the parasites lying within the epithelial cells. The tubules of the mucous surface of the bowel are often distended by the parasites, some are ruptured, and the epithelium is destroyed. Sections through the discoloured areas of the liver also determine the presence of the parasite on microscopic examination.

TREATMENT.

In the event of any poultry or other domesticated birds dying or showing symptoms corresponding with those narrated they should be at once isolated and steps taken to ascertain the nature of the malady. Communication with any of the Department's live-stock officers will ensure the necessary assistance to this end. Sick birds should receive the best of feed and attention, the object being, as in all parasitic infections, to render the natural powers of resistance of the host able to withstand the parasitic invasion. Warm new milk should be offered, and mashes prepared with milk in place of water. Fresh clean drinking-water should at all times be accessible. Valuable birds may be given such delicacies as finely chopped-up hard-boiled eggs and meat. Coarse indigestible foodstuffs should be avoided. Grain should be given crushed or steeped in milk. Bran is better withheld.

As regards medicinal treatment little can be said with confidence. Among the various agents recommended are sulphate of iron (10 grains to the gallon of water) and permanganate of potash added to the drinking-water until it attains a pink colour. Kerosene or oil of turpentine mixed with the food is said to be efficacious. Catechu has also been recommended, given in the drinking-water in the proportion of 10 to 15 grains to the gallon for the larger species, and continued for ten to fourteen days. If oocysts are still present in the fæces the treatment is continued, giving 5 to 8 grains of crude catechu to the gallon of water until symptoms decline and the parasites cease to appear in the droppings. Morse and Jowett have tried treatment by means of sulphate of iron and salicylate of soda. The iron is given dissolved in the drinking-water in the proportion of 10 grains to the gallon, while the salicylate of soda is given in pill form—2-grain to 3-grain doses—every evening. The results following this treatment have varied, though Jowett considers that on the whole it has been of some slight benefit.

The measures suggested by the English Board of Agriculture, and referred to by Jowett, comprise the following recommendations :—

1. Owing to the difficulty and practical impossibility of disinfecting a poultry-run a change to fresh ground is necessary. If, however, the infected stock is moved to fresh ground, that ground will rapidly become infected. The old stock should therefore be left where it is, any birds which show symptoms of the disease being promptly killed. Only newly hatched chicks should be placed on the new ground, and all brooders, coops, feeding- and watering-utensils should be thoroughly disinfected before use. There must be no communication with the old infected yard.

2. If hens are used for hatching there is a danger that they may infect the chicks; but if hens are preferred, then broody hens must be

purchased from clean stock. Some of the infected hens may deposit coccidia on the shell of the egg, and if the disease has attacked their oviducts coccidia may be found inside the egg. In either case the young chick may become infected and suffer from the disease known as white diarrhœa of chicks. All eggs before being set should therefore be dipped into a solution of 90 per cent. of alcohol and 10 per cent. of water.

3. If these suggestions cannot be carried out, or if fresh ground cannot be provided, the best procedure is (*a*) to kill all birds exhibiting the first symptoms of the disease; (*b*) to take off about 3 in. of the top soil of the most frequented parts of the runs, and disinfect or burn it; (*c*) to disinfect thoroughly all houses, roosts, laying-nests, food and water utensils; (*d*) to use only healthy hens for setting; (*e*) to place eggs in a solution of 90 per cent. alcohol before setting them.

For the general cleaning-up and disinfection of coops, buildings, &c., frequented by the diseased birds it is advisable to wash them down with boiling water containing a little ordinary washing-soda, and finally to limewash them, using the limewash while hot.

ERADICATION OF SILVER-FERN.

It is generally admitted that the control on broken country of silver-fern (*Pteris scaberula*), which occurs so freely throughout the King-country of the North Island, and elsewhere, presents a difficult problem —far more so than in the case of the ordinary bracken-fern. From the experience of settlers and the writer's own observations it would appear that there are only two effective methods of treatment. The first method is to subdivide the area, and stock heavily with sheep or cattle according to the conformation of the land, but the more cattle the better. If possible there should be three paddocks, and the stock should be ten days in each, or ten days on and twenty days off. The number of stock should be regulated so that they will have fair feed for, say, seven days, but during the last three days will have to work for their living. As the patches of fern are crushed out they should be surface-sown with a heavy seeding of grasses suitable to the district. If the land is steep the mixture should contain a large percentage of Danthonia pilosa. The other method is to fire the patches of fern. This can sometimes be done in the early spring after a few frosts when the sap is right down, but the best and safest time is about the end of March. It is necessary that the fern be very dry so as to ensure a good hot fire, a poor fire doing more harm than good. For this reason considerable judgment is necessary in burning, and if the conditions are not ideal one should wait, even if it means missing a year, rather than risk a bad burn. As soon as the ashes are cool apply a heavy seeding of grass-seed as recommended under the first method. It is very important that the seed be sown before rain has fallen. A great deal of the success of the operation depends on this. The foregoing note was prompted by an inquiry from a King-country correspondent who used the name silver-fern. *Pteris scaberula* is also variously known as carpet-fern, creeping-fern, hard-fern, and pig-fern.—*J. W. Deem, Fields Instructor, Wanganui.*

MORTALITY AMONG STONE-FRUIT TREES IN CENTRAL OTAGO.

A RECENT INVESTIGATION.

G. H. CUNNINGHAM, Biology Section.

An investigation of the causes of a marked mortality or stunted growth among stone-fruit trees in Central Otago was undertaken by the writer in conjunction with other work during a recent visit to that district with Mr. J. H. Thorp, Orchard Instructor. The trouble in question is more or less general throughout Central Otago, but is specially marked in the localities of Ettrick, Roxburgh, Alexandra, Clyde, and Cromwell.

In some orchards only an occasional dead tree was observed; in others whole blocks were more or less affected. Apricots appear to be the most susceptible—the variety Moorpark particularly so; next in susceptibility comes the nectarine; then the peach. Apples, pears, and cherries appear to be but little affected.

The causes of this mortality appear to be many and, in some instances, hard to define. We found dead trees in low localities where drainage was poor, and in high parts where the drainage appeared to be good; odd affected trees scattered among a block of perfectly healthy trees, or whole rows or blocks affected; in irrigated and unirrigated areas, cultivated and uncultivated areas, &c. In the majority of cases, however, the death of any one particular tree could be traced to one of the three following factors: (1) Excess of water in the soil; (2) unsuitable soils; (3) fungous diseases.

EXCESS OF WATER IN THE SOIL.

This excess is largely caused through faulty irrigation, or through flood-water, abnormal rainfall, &c. By far the greatest number of dead or dying trees occur in orchards constantly irrigated. This was so apparent that we inquired fully into the method of irrigation in vogue. The method most commonly applied appears to be as follows:—

The water is led from the main races to smaller races which lead on to the higher ground in the vicinity about to be irrigated. Small channels, usually made with a plough, are run, one on each side, down the lines of trees as far as the natural fall will carry the applied water. Into these channels the water is led and allowed to run until it reaches the farther end, where it either remains and forms pools or (rarely the case) is led away by a farther channel ploughed for this purpose, which runs at right angles to the channels used for irrigating. The water may be run into the channels only for such time as it takes to reach the end of the line of trees being irrigated, or may be allowed to run until the orchardist is satisfied that the soil is well saturated, this last being the method favoured by the majority. Needless to say, as the surface of the ground is more or less undulating, due to the method of ploughing, the quantity of water received varies greatly in the case of

different trees. In some places there may be a slight depression, this naturally becoming filled before the water continues down its allotted channel; other places, again, will receive but little water, as they may be on high ground.

No provision is made for soil-drainage, the orchardist usually being under the impression that the soil is sufficiently porous to carry away the surplus water. This is rarely the case, as in a large number of orchards visited a hard-pan underlying the surface soil was observed. This hard-pan was usually in the form of a white concrete-like mass, varying in thickness and occurring at varying depths in the soils in question.

Where water had accumulated in slight depressions, or where the soil had become saturated owing to the proximity of the hard-pan to the surface, we invariably found dead trees. Many cases were observed of trees that had been subjected to an excessive amount of water, and had perished as the result. In one instance a block of about an acre had been flooded by the bursting of a race. Although the water had been on this land only for about a week, it was noticeable that the greater number of the stone-fruit trees had succumbed. Apples and pears, on the other hand, were but little affected by this particular flooding. Cases where one or two trees had died, the remainder of the trees in the orchard being quite normal, were investigated, and invariably one could trace the cause of death to the effect of excess water which had seeped from adjacent races.

A plentiful supply of oxygen is necessary to enable a plant to perform the phenomena of cell-division, respiration, and other functions associated with plant-life. This oxygen is obtained from the atmosphere, and to a lesser extent from the air in the soil and the soil-moisture. A porous well-cultivated soil favours the admission of oxygen to the plant root-hairs, while a close, tenacious, compact soil hinders it. When the soil becomes saturated with water the air is driven out. If this excess of water remains but a short time no harm is done to the plant, as it is able to obtain the necessary oxygen in solution from the water. Should the excess of water persist beyond a very short period the oxygen in solution becomes exhausted (the water becomes "stagnant") and the plant root-hairs die, as the protoplasmic contents are only able to live and perform their functions when this essential element is present.

It is obvious that, as excessive moisture is one of the causes, some provision made for the removal of this excess would tend to prevent a recurrence of the trouble. Subsoil drainage would, by rendering the soil more pervious and by preventing water lying in pools round the trees, probably be the most effective remedy. Where one or two trees have died in patches, one or two drains in their vicinity would suffice. The breaking of the hard-pan with explosives would certainly have a beneficial effect.

UNSUITABLE SOILS.

Many of the orchards now suffering the loss of a large percentage of stone-fruits are planted on soil that is quite unsuitable for stone-fruit culture. The old idea that any soil is suitable for fruitgrowing has never proved more fallacious than at the present time. Many acres of stone-fruit trees have been planted on poor gravelly soils.

For a time the trees have thriven, but as soon as they have utilized the available plant-food in their vicinity they have gradually become stunted and weakened, and have either died outright or become an easy prey to the attacks of various fungi. With trees on this class of soil one can do little, as at best they will be stunted and incapable of bearing a profitable crop. It would be more profitable to use the soil for other purposes.

Beginners before purchasing or planting would do well to consult the Orchard Instructor for the district as to the suitability or otherwise of the land they intend to purchase or plant.

Many acres of orchards have been planted on land that appears to be first-class orchard land; but in a few seasons trees on this land become more or less stunted, and make but little growth. As a rule, this stunting is not general, the major number of the trees planted being perfectly normal and healthy, while in small patches here and there amongst them a few trees become so stunted as to appear in marked contrast to their vigorous growing neighbours.

At the time of our visit these patches of stunted trees were very noticeable. Some appeared to be affected this season for the first time; others, again, appeared to have made but little growth since being planted.

Trees may be wholly stunted or merely have one or two branches affected. These affected branches (or the whole tree, as the case may be) are much weaker than normal, have fewer leaves, the leaves being usually smaller, of a yellowish colour (chlorotic), strongly incurved, and as a rule decidedly brittle. They are, as a rule, badly infected with powdery mildew (*Podosphaera oxyacanthae* De Barry). Frequently the greater number of the fruit- and leaf-buds are too weak to perform their functions, and produce but few leaves and few flowers, which fail to set fruit.

Presence of Alkali Compounds.

The cause of this stunting (and sometimes dying outright) is the presence in the soil of varying quantities of one or more compounds which create that class of soil known as "alkali." Many of the orchards are planted on the sites of old conservation dams which were used for sluicing. These alkali compounds, being as a rule readily water-soluble, have been brought in by water-races running through strata in which these compounds occur (this alkali country appears to be fairly plentiful in the surrounding hills), and have gradually through the years accumulated in these dams by sedimentation, evaporation, &c. Again, natural depressions in the ground have been gradually filled up by soil, &c., brought down by rain-water. Alluvial fans deposited from the adjacent hills would in a lesser degree contain quantities.

Trees planted on the old sites of these dams or depressions would to a greater or less extent suffer from the alkali contained in the soil, according to whether they were near the periphery or centre of the dam or depression. The water at present used for irrigating, if running through these alkali strata (and we found many races did so), would also bring these salts in solution, and gradually increase the soil percentage. Where irrigation pools have formed round the trees these salts would gradually be deposited through evaporation of the water. This is apparent in many places where trees have been killed outright.

Where there is not too great a quantity of alkali in the soil, and where irrigation is practised, the remedy would be a thorough system of subsoil drainage. These drains would serve to carry off the surplus water with the alkali in solution. Irrigation without drainage causes a worse alkaline condition by bringing to the surface subsoil alkali, and by allowing a greater accumulation from the supply in the irrigating water. Where irrigation with subsoil drainage cannot be resorted to an application of gypsum may prove beneficial.

Where the alkali patches are marked, fruitgrowing would be a very hazardous occupation, as it is doubtful if the trees would succeed. On one block of about half an acre that had been planted with both stone and pome fruits the soil was markedly alkaline, and every tree succumbed. Crops of beet, mangolds, cabbages, asparagus, &c., can, however, be successfully grown on these patches.

FUNGOUS DISEASES.

Many dead or dying trees were observed growing on what appeared to be good well-drained soil free from alkali. Closer examination of branches, &c., of these affected trees frequently revealed the presence of fructifications of fungi, two of which occurred so frequently that we were led to believe that they may be associated with the dying of these particular trees. Specimens of these fungi were collected from various trees in the various districts, and were taken to the Biological Laboratory, where they were microscopically examined.

These fungi the writer has identified as follows: (*a*) *Valsa leucostoma* (Pers.) Sacc.; (*b*) *Nectria cinnabarina* (Tode) Fries.

Valsa leucostoma.

The conidial stage of *Valsa leucostoma*—known as *Cytospora cincta*—has been known for many years as a parasite of stone-fruit trees. It is only an active parasite where the tree has become previously weakened by frost or other injury. Fructifications were collected from dead branches of peaches, nectarines, and apricots.

The presence of this disease is usually indicated by the wilting of a branch or limb of the infected tree. At or preceding this wilt stage masses of gum appear on various parts of the infected branches, usually at the base of the wilted portions. At a later stage minute pustules appear on the dead areas. From these pustules thread-like pinkish tendrils, often an inch or more in length, are produced. These tendrils consist of myriads of very minute spores, each spore being about $\frac{1}{6000}$ in. in length, embedded in a gelatinous substance.

This gelatinous substance is readily water-soluble; and when dissolved the spores are freed to be carried by rain, wind, &c., to other parts of the tree or to other trees, where, given favourable circumstances, they are capable of starting the disease afresh. Birds may also assist in this spore-dissemination, for the spore-bearing tendrils are viscid, and may become attached to the birds' feet when they alight on affected branches, and so become carried from tree to tree.

This fungus is not directly capable of attacking any branch, but can readily infect through wounds, dead shoots, frost-injured portions, &c. It is significant that on a great number of the trees examined numbers of dead lateral shoots were present. Many of these laterals had been

killed by spray injury, but the greater number had succumbed through being immature, the result of a prolonged mild autumn—during which they had retained their foliage and continued growing until the first frosts—followed by a severe winter.

A large percentage of the trees were first attacked through these greatly weakened or dead laterals. The fungus, once it has gained a footing on such trees (which have been weakened by the great loss of leafage, caused by the large amount of dead laterals), soon makes its way into the larger branches and kills them outright. Death is brought about by the mycelium of the fungus blocking the conduction vessels, preventing the passage of water, &c.

Control measures are difficult, as once the fungus has entered the tissues spraying with the usual fungicides would be of little avail.

As the fungus can only attack a tree that has become weakened or is carrying weakened or dead laterals, anything that can be done to give the tree greater vitality—such as thorough cultivation, judicious applications of manure, &c.—would be in the nature of a remedial measure. Trees growing on poor soils, especially soils that have an underlying hard-pan, are very susceptible to the attacks of this fungus. Here applications of manure, breaking of the hard-pan, &c., would prove beneficial.

As it has been pointed out that one source of infection is through weak or dead laterals, anything that will induce normal lateral growth which will be properly ripened before the dormant season will be a great aid in combating this disease. Judicious pruning, and thinning-out of lateral growth, particularly water-sprouts, the removal of all dead twigs, and painting-over of large wounds, should be practised. Where branches have been infected they should be cut out and burned. The wounds made should be then dressed with a disinfectant, and painted over. A good disinfectant to use would be corrosive sublimate, 1 part to 1,000 parts of water.

Nectria cinnabarina.

Apricots, and to a lesser degree peaches, suffer a good deal from the attacks of this fungus. The appearance of affected trees is somewhat similar to those attacked by *Valsa leucostoma*. Branches, apparently healthy and carrying a good show of foliage, suddenly wilt and die in a very short time, the foliage and fruit shrivelling and remaining on the infected branch for a considerable time after it is dead. Some little time before the wilt stages patches of gum appear in various places on the branch. Microscopic examination of the tissues in the vicinity of these gumming patches invariably reveals the presence of quantities of fungous mycelium, which appears to block the conduction vessels. Large cracks in the bark frequently appear near these gumming areas, probably the result of ruptures in the cortex caused by masses of gum bursting through.

Following the death of the branch, pustules of the fructifications of the conidial stage of the fungus (*Tubercularia vulgaris*) burst through the cortex. These are at first a pale pink, but soon change to a deeper shade of pink. This fungus is a common saprophyte, and may be found on a large variety of dead wood, but it is capable of becoming an active parasite if given favourable opportunity. Excessive gumming and

subsequent cracking of the bark, wounds caused by the removal of large limbs, plough injury, splitting of branches where they join one another, &c., all afford an opening for the ingress of this fungus. Excessive gumming is largely caused through unfavourable soil conditions, such as excessive soil-water, poor light gravelly soils, &c. This trouble is particularly noticeable on poor ridges.

Remedial measures would be similar to those mentioned for *Valsa leucostoma*.

DEFECTIVE NURSERY STOCK.

Many young trees that had died the season they were planted were examined, and in the majority of cases these trees were seen to have been very poorly worked in the nurseries, as large wounds were noticeable on the stocks where they had been budded. Many of these trees had been twice worked, and two or more large gaping wounds, which, owing to the greatly weakened state of the trees, would have but little chance of callusing over, were noticeable. These wounds afford such an excellent opening for the fungi which have been described that growers would do well to refuse any such trees inadvertently forwarded by nurserymen.*

CONCLUSION.

From the foregoing it is evident that excessive soil-water plays an important part in the causes of the mortality amongst stone-fruit trees in Central Otago. This excessive water may be due to faulty irrigation, floods, abnormal rainfall at any particular period, &c. This trouble should be largely rectified by some method of subsoil drainage. It is significant that the fungi mentioned are only able to become markedly parasitic where trees have become weakened or injured in some manner. No doubt excessive water has had a good deal to do with this condition.

* Inferior trees, such as those referred to, should in any case not be accepted by the orchardist, as they do not comply with the provisions of the fruit-tree-grading regulations.

The Opossum Question.—At the annual meeting of the Wellington Acclimatization Society, held last month, the president expressed the opinion that an opossum season should be opened under license in suitable districts. Professor H. B. Kirk had gone into the whole question very fully. In a fruit district the opossum should not be protected, but in native bush they did no damage. Damage was done to native bush by pigs, deer, and particularly by cattle. Authority should be given to trap opossums by license, the fees to go to societies. Revenue from opossum licenses on Crown land might be used for the benefit of scenic reserves. The conclusions of Professor Kirk were that opossums did do damage to orchards, and in fruit districts there should be an open season perpetually. Although plantations were liable to suffer, the native bush did not suffer appreciably, and might be heavily stocked. The opossum trade was valuable, and might be made more valuable still by development. Licenses should be issued to trappers, and the mountain-ranges should be stocked with the best Tasmanian brown opossums.

LUCERNE ON RIVER GRAVEL AND ON COASTAL SAND.

F. E. WARD, Instructor in Agriculture, Wellington.

THE fact that lucerne will not stand "wet feet" can only be said to apply to stagnant water, for on a recent visit to Marlborough fields were inspected which grew excellent lucerne down to the water's edge of streams. The accompanying photograph shows lucerne growing on pure gravel in the bed of the Flaxbourne River, on the property of Mr. Alex. Thomson, of Ward. This lucerne has been covered with water several times since being sown, the last time to a depth of several feet (a few weeks previous to the photo being taken), on which occasion the shingle shown in the foreground was deposited. The

LUCERNE GROWING ON GRAVEL IN BED OF FLAXBOURNE RIVER.
[*Photo, D. Wilton.*

method of establishment is sowing broadcast on the shingle after floods. This shingle is of a calcareous nature, whitish in colour, the situation being at the foot of a limestone hill.*

An interesting case of lucerne growing on the sea-front at Ward, a few feet above high-water mark, also came under the writer's notice. An area at the foot of the hill above the beach, composed of mere sand and growing tauhinu and other rubbish, has been fenced off, cleared, disked, and sown with lucerne. Wherever the sand remained fairly stationary the plants have become well established. Marram-grass has now been planted with the idea of holding the sand when further lucerne-seed will be broadcasted among it. There is a good prospect that a waste area will thus be converted into remunerative grazing.

* See also *Journal* for February, 1916, page 110.

IMPORTATION OF FERTILIZERS.

ANNUAL STATISTICS AND REVIEW.

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

STATISTICS of artificial fertilizers imported into New Zealand during the year ended 31st March, 1920, are now available, and have been specially compiled for the *Journal* in the accompanying tables.

Comparing the 1919–20 figures with those of the previous twelve months, it will be noticed that there is a considerable improvement in the quantity of all phosphates imported, except in the case of superphosphate, of which some 5,500 tons less were received.

Considering the phosphates categorically in the order in which they are stated, bonedust shows a considerable decrease in the last three years, although in pre-war times there was also a progressive decrease, doubtless owing to competition of other phosphates. The decrease in war years must be referred to other causes.

Basic slag in the pre-war years showed highly progressive increases in the figures, rising from 8,600 tons in 1911 to 30,350 tons in 1914. As this is pre-eminently a pasture top-dressing fertilizer suitable for most climates, the decline in its importation has been one of the most serious war-time shortages for New Zealand. The figures show the importation to have sunk to nil in 1918–19, but there was some revival in 1919–20, when 2,759 tons were imported.

The importation of superphosphate before the war was a fairly constant quantity. While it could be obtained from Australia the demand for a quick-acting fertilizer led to an increase in the imports in 1915 and 1916. From this time the figures show a great decline—from 58,000 tons to 15,000 tons in 1919–20, which is less than half the pre-war figures.

As against these decreasing quantities it is satisfactory to be able to record an increase in the importation of "guano," or what is really rock phosphate, the figures for the war years being greater than any hitherto recorded. The phosphate in rock phosphate is, of course, in the insoluble form, but it is anticipated that when it is finely ground it will be valuable for many purposes for which basic slag and even superphosphate are now used. To the credit side of the fertilizer position in New Zealand must also be placed the arrival in war years of the new phosphate from Egypt under the trade-name of Ephos, or Egyptian phosphate. The use of this fertilizer commenced in New Zealand in 1916, when the first cargo of 2,000 tons was received. In the 1918–19 twelvemonth, owing to war conditions, no Ephos arrived in New Zealand, but with that exception every year has shown a steady increase in the quantity imported, culminating in 15,000 tons for 1919–20.

SUMMARY OF KINDS, QUANTITIES, AND DECLARED VALUES OF FERTILIZERS IMPORTED DURING YEARS ENDED 31ST MARCH, 1919–20 AND 1918–19.

Fertilizer.	Weight.		Value.	
	Year 1919–20.	Year 1918–19.	Year 1919–20.	Year 1918–19.
	Tons.	Tons.	£	£
Bonedust	6,272	3,468	66,412	31,054
Bone char	825	200	4,889	1,149
Bone and blood	288	79	3,897	1,175
Basic slag	2,759	..	15,852	..
Egyptian basic phosphate ..	15,000	..	77,000	..
Superphosphate	15,842	21,400	88,120	114,999
Guano and rock phosphate	38,861	31,351	90,812	61,240
Potash	65	30	2,054	1,028
Gypsum	..	342	2	828
Sulphate of ammonia	67	10	1,869	349
Nitrate of soda	135	204	3,816	3,435
Sulphate of iron	8	64	109	826
Manures unspecified	711	202	3,859	1,668
Totals	80,833	57,350	358,691	217,751

NOTE.—With regard to the "declared values" given above, the Comptroller of Customs supplies the following explanation: "The value for duty is defined as the fair market value in the country whence the goods are imported, plus 10 per cent. As the addition of 10 per cent. does not nearly cover the presen. freight, insurance, and other charges, the statistical value is a long way less than the actual landed value."

DECLARED IMPORT VALUES PER TON OF CHIEF PHOSPHATIC AND SOLUBLE NITROGENOUS FERTILIZERS FOR 1919–20 AND 1918–19.

	Year ended 31st March, 1920.	Year ended 31st March, 1919.
	£ s. d.	£ s. d.
Bonedust	10 12 0	9 0 0
Basic slag	5 15 0	Nil.
Egyptian phosphate	5 2 8	,,
Superphosphate	5 11 0	5 7 6
Guano and rock phosphate ..	2 7 0	1 19 0
Nitrate of soda	28 5 0	16 17 0
Sulphate of ammonia	27 18 0	34 18 0

IMPORTS OF THE PRINCIPAL PHOSPHATIC FERTILIZERS FROM 1911 TO 1920.

Year ended 31st March.	Bonedust.	Basic Slag.	Superphosphate.	Guano and Rock Phosphate.	Ephos.
	PRE-WAR IMPORTS.				
	Tons.	Tons.	Tons.	Tons.	Tons.
1911	11,058	8,670	27,442	15,963	Nil.
1912	10,799	16,227	32,567	22,050	,,
1913	9,281	20,133	32,964	25,033	,,
1914	6,578	30,350	41,582	22,093	,,
	WAR AND POST-WAR IMPORTS.				
1915	7,966	29,385	54,190	23,983	Nil.
1916	10,059	10,339	58,013	39,366	2,026
1917	10,386	6,660	31,962	24,993	8,614
1918	6,363	10	37,157	37,037	11,225
1919	3,468	Nil	21,400	31,351	Nil.
1920	6,272	2,759	15,842	38,861	15,000

IMPORTATION (IN TONS) OF PRINCIPAL ARTIFICIAL FERTILIZERS FOR YEAR ENDED 31ST MARCH, 1920, SHOWING COUNTRIES OF DEPARTURE AND NEW ZEALAND PORTS OF ENTRY.

New Zealand Port of Entry.	Australia.					Chile.	India.		Japan.	Pacific and Indian Ocean Islands.		United Kingdom.						United States.		Egypt.
	Nitrogenous Manures.	Bonedust and Blood-and-bone.	Superphosphate.	Rock Phosphate and Phosphate unspecified.	Other Manures.	Nitrogenous Manures.	Potash Manures.	Bonedust.	Superphosphate.	Name of Islands.	Rock Phosphate.	Nitrogenous Manures.	Superphosphate.	Gypsum.	Other Manures.	Basic Slag.	Iron Sulphate.	Nitrate of Soda.	Iron Sulphate.	Basic Phosphate.
Auckland	68	2,979	2,641	471	811	..	30	1,758	..	Makatea Island	16,060	..	..	..	21	1,650	..	..	..	9,270
										New Caledonia	1,515									
										Gilbert and Ellice Islands ..	3,300									
Kaipara	..	90	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
New Plymouth	..	140	845	..	..	..	..	..	..	New Caledonia	1,500	..	..	..	..	950	..	..	..	..
Wanganui	..	..	810	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wellington	70	717	5,007	1,778	..	..	..	350	..	..	..	..	..	..	102	..	1	..	..	5,730
Lyttelton	8	..	2,188	1,027	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Timaru	..	..	1,000	..	..	..	..	..	..	New Caledonia	270	..	..	..	..	..	..	..	..	..
Oamaru	..	..	375	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dunedin	20	202	823	..	25	..	..	..	..	Makatea Island	4,147	..	..	..	..	..	7	..	..	..
										New Caledonia	1,600									
Invercargill	36	339	1,818	..	350	..	..	275	..	Makatea Island	6,064	..	..	..	..	..	..	..	..	..
										New Caledonia	1,536									

NOTE.—For the previous year's corresponding statistics see *Journal* of June, 1919, page 359.

MEADOW TOP-DRESSING TEST AT MARTON.

C. H. SCHWASS, Fields Instructor, Wanganui.

IN 1917 the Department commenced an experiment on the property of Messrs. Deighton and Purnell, Marton Junction, for the purpose of ascertaining the respective values of certain top-dressings on the typical heavy land of the Marton district. An area of 6 acres of meadow was divided into six plots of 1 acre each, and the plots were top-dressed on 20th October as follows :—

Plot 1 : Control—no manure.

Plot 2 : Carbonate of lime, 1 ton.

Plot 3 : Carbonate of lime, 1 ton ; superphosphate, 3 cwt. ; sulphate of potash, ½ cwt. ; blood, ½ cwt.

Plot 4 : Carbonate of lime, 1 ton ; superphosphate, 3 cwt. ; sulphate of potash, ½ cwt.

Plot 5 : Carbonate of lime, 1 ton ; superphosphate, 3 cwt.

Plot 6 : Papa rock, 2 tons.

The whole area has been closed up for hay in each of the three seasons since being top-dressed. The accompanying table gives the period for which the field was closed up each year ; the weight per acre of green material cut each year ; the total weight per acre of green material cut for the three seasons ; the value of the hay for the three years ; the cost per acre of the manure applied ; and the increased return for the hay in each case over the "no manure" or control plot.

It will be seen that all the areas treated produced more feed and revenue than the untreated area, especially in the case of those plots treated with a fairly complete manure—namely, Nos. 3, 4, and 5. In addition to increased quantity of hay it is reasonable to assume that during the period the area was open to grazing each year the top-dressed plots produced proportional increases in herbage. It is known from general experience that the material produced on top-dressed areas has a higher nutritive value than that on untreated land, but no steps were taken to actually prove this in the present case. What was apparent, however, was that during the autumn, winter, and spring months of each year, when the whole of the area was grazed with sheep and horses (which stock had the run of all the plots simultaneously), they showed a preference for plots 3, 4, and 5, in the order mentioned. These plots were always eaten more closely than the others. They also showed a much closer sward, and clovers were more prominent. The areas top-dressed with lime and papa respectively displayed a greener appearance than the "no-manure" area, and also produced slightly more clovers. The pasture on the no-manure plot remained coarse, and there were hardly any clovers showing, this having been the condition of the whole of the field at the time the top-dressings were applied.

MEADOW TOP-DRESSING TEST AT MARTON JUNCTION, 1917–19.

Plot No.	Season.	Date closed.	Date cut.	Weight of Green Material per Acre.	Total Weight for Three Years per Acre.	Value of Hay for Three Years at £4 per Ton.*	Increased Return for Three Years over "No Manure" Plot.	Cost of Manures per Acre.†	Net Increased Return for Three Years.
				Tons.	Tons.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1 ..	1917–18	24/10/17	20/12/17	3·65					
1 ..	1918–19	16/10/18	6/1/19	2·89	11·60	15 8 10	..	..	..
1 ..	1919–20	16/10/19	22/12/19	5·06					
2 ..	1917–18	24/10/17	20/12/17	4·28					
2 ..	1918–19	16/10/18	6/1/19	4·18	14·48	19 6 5	3 17 7	1 0 0	2 17 7
2 ..	1919–20	16/10/19	22/12/19	6·02					
3 ..	1917–18	24/10/17	20/12/17	5·90					
3 ..	1918–19	16/10/18	6/1/19	6·26	19·87	26 9 7	11 0 9	2 17 0	8 3 9
3 ..	1919–20	16/10/19	22/12/19	7·71					
4 ..	1917–18	24/10/17	20/12/17	5·70					
4 ..	1918–19	16/10/18	6/1/19	5·94	18·50	24 12 10	9 4 0	2 11 0	6 13 0
4 ..	1919–20	16/10/19	22/12/19	6·86					
5 ..	1917–18	24/10/17	20/12/17	5·22					
5 ..	1918–19	16/10/18	6/1/19	5·14	16·38	21 16 10	6 8 0	2 1 0	4 7 0
5 ..	1919–20	16/10/19	22/12/19	6·02					
6 ..	1917–18	24/10/17	20/12/17	4·55					
6 ..	1918–19	16/10/18	6/1/19	3·85	13·30	17 14 5	2 5 7	2 0 0	0 5 7
6 ..	1919–20	16/10/19	22/12/19	4·90					

* Two-thirds weight of green material is allowed in each case for shrinkage.
† The price per ton of the various manures used was—Superphosphate, £7; sulphate of potash, £20; blood, £12; carbonate of lime, £1: papa, £1

History of Field.—Following are some details of the history of the field prior to the commencement of the test here dealt with: Before 1909 the field was for several years cropped with oats. About 1909 it was sown down with the usual grass-mixture used in the district, except that more than the average amount of clover was included. No manure was sown with the grass-mixture. During the five years 1912 to 1916 the paddock was used for horses and cows, with a few sheep for killers. The whole field was top-dressed in 1913 with basic slag, bonedust, and Gear grass-manure, at the rate of 1½ cwt. to 2 cwt. per acre.

COST OF FEEDING PULLETS TO SIX MONTHS OLD.

TRIAL AT MILTON POULTRY-STATION.

F. C. BROWN, Chief Poultry Instructor.

DURING the past season a trial was conducted at the Milton Poultry-station to ascertain the cost of feeding pullets to the age of six months. Sixty White Leghorn chickens were placed in brooder. Of these, seven died when a few days old, and of the remainder twenty-nine proved to be pullets and twenty-four cockerels. The cockerels were separated from the pullets when they had attained a weight of about 3½ lb., and the available market price for these—4s. each—was credited to the pullets, while the whole cost of feeding was charged against the pullets.

The following are particulars and actual cost of the food supplied to the chickens during the six-months period of the test :—

	£ s. d.	£ s. d.
Whole wheat, 1,008 lb., at 6s. 8d. per bushel		5 12 0
Cracked wheat, 187 lb., at 6s. 8d. per bushel	1 0 9	
Add cost of cracking ..	0 1 6	
		1 2 3
Crushed wheat, 112 lb., at 6s. 8d. per bushel	0 12 5	
Add cost of crushing ..	0 0 9	
		0 13 2
Pollard, 769 lb., at £9 5s. per ton		3 11 2
Bran, 254 lb., at £7 5s. per ton		0 18 5
Oatmeal, 26 lb., at 6s. 9d. per 25 lb. bag ..		0 7 0
Hulled oats, 264 lb., at 4s. per bushel ..	1 6 5	
Add cost of hulling ..	0 6 7	
		1 13 0
Rolled oats, 45 lb., at 35s. per 100 lb. ..		0 15 9
Meat-meal, 21½ lb., at 20s. per 100 lb. ..		0 4 4
Total		14 17 1
Deduct price realized for twenty-four cockerels sold at 4s. each		4 16 0
Net total cost		£10 1 1

Dividing this sum by 29 (the number of the pullets reared), the average net cost of food for one pullet works out at 6s. 11¼d.

During the six months eggs to the value of £1 8s. 6d. were laid, but no credit is allowed for this amount, it having no bearing on the object of the trial.

NOTE.—The above-recorded experiment was carried out at the request of the New Zealand Poultry Association.

WOOLLY-APHIS CONTROL.

EXPERIMENTS AT ARATAKI.

T. E. RODDA, Manager, Arataki Horticultural Station.

DORMANT AND BUD-DEVELOPMENT PERIODS.

An experiment to ascertain the best means of controlling woolly aphis by applying oils and other compounds during the dormant and bud-development periods was carried out at Arataki during the past spraying season. Twelve plots of fifteen trees were selected and treated as follows :—

No. of Plot.	Treatment.	Period applied.	Date applied.
1	Red oil, 1–6	Dormant	5 Aug.
2	Red oil, 1–8	Dormant	5 Aug.
3	Red oil, 1–10	Dormant	4 Aug.
4	Red oil, 1–10	Bud-movement	22 Aug. to 9 Sept.
5	Red oil, 1–10	Tight-cluster	9 Sept. to 3 Oct.
6	Red oil, 1–15	Tight-cluster	9 Sept. to 3 Oct.
7	Red oil, 1–30	Expanded-cluster	16 Sept. to 3 Oct.
8	Red oil 1–10, heated to 120° (sprayed)	Dormant	12 Aug.
9	Red oil 1–1, heated to 120° (painted)	Dormant	12 Aug.
10	Red oil 1–1, cold (painted)	Dormant	2 Aug.
11	Pomsol, 1–1 (painted)	Dormant	2 Aug.
12	Crude vaseline (painted)	Dormant	2 Aug.

Plots 1 to 7 were examined for results on 8th November and again on 23rd January. The results stated in numbers of aphis colonies observed were as follows :—

No. of Plot.	8th November.	23rd January.	Remarks.
	Colonies.	Colonies.	
1	4	74	
2	10	84	
3	37	237	Aphis was present on all portions of the trees in all plots.
4	18	110	
5	13	91	
6	223	Very numerous	
7	245	Very numerous	

Plots 8 to 12 were examined for results on 3rd November, 12th December, and 23rd January. The results were as follows :—

No. of Plot.	3rd November.	12th December.	23rd January.	Remarks.
	Colonies.	Colonies.	Colonies.	
8 ..	Nil	Nil	14	Mostly on young wood.
9 ..	1	20	42	Mostly on young wood.
10 ..	9	22	87	About evenly distributed.
11 ..	8	12	55	On all portions, both old knots and young wood.
12 ..	9	23	93	All on young wood and portions not painted at time of treatment. Old knots that had been well painted free.

From the observations it will be seen that the treatment on plot 8 (oil, 1–10, heated 120° and sprayed) gave the best results, while plot 9 (oil, 1–1, heated to 120° and painted) came second. The treatment by painting with crude vaseline controlled the pest very effectively on the old knots where it was applied. Infected places were the only portions painted during dormant period. The heavy sprayings of oil—*i.e.*, 1–6 and 1–8—during dormant period proved to be more effective up to a certain period than the weaker strengths applied during bud-movement, tight-cluster, and expanded-cluster.

In may be added that the treatment applied to plot 8 gave the best red-mite control of any of the treatments applied to the sprayed trees. It did not by any means exterminate the pest, but the trees in this particular plot were more free from mite during January, although there has been a fair number of winter eggs deposited.

GROWING-PERIOD.

Another experiment was carried out during the season for control of aphis, the treatment in this case being applied during the growing-period. Six plots were treated respectively as follows :—

Plot 1 : Blackleaf 40, 1–800.

Plot 2 : Blackleaf 40, 1–800, plus 3 lb. soft-soap to 100 gallons.

Plot 3 : Blackleaf 40, 1–800, plus 5 lb. soft-soap to 100 gallons.

Plot 4 : Blackleaf 40, 1–800, plus lime-sulphur, 1–120.

Plot 5 : Pomsol, 1–40.

Plot 6 : Pomsol, 1–60.

The first spraying was done on 29th January, when there was a fair amount of aphis showing. An examination for results was made three days after spraying. The colonies in all plots that had been treated with Blackleaf 40 were killed where a direct hit had been registered and the woolly covering blown away, but small colonies that were not very conspicuous and had not received special attention were very active. In the plots treated with Pomsol the mortality among the aphides was not so great as in the plots treated with Blackleaf alone or in conjunction with soap or lime-sulphur. Wherever the colonies had received an extra heavy drenching most of the insects were killed, but all the smaller colonies that had only received a wetting at time of spraying were apparently unharmed.

A further examination was made on 23rd February. Aphis was very numerous on all trees in plot 1. It was very numerous on the new wood, and was very active on the old knots. Plots 2 and 3 were freer from aphis than plot 1, but it was still numerous. No difference could be determined between plots 2 and 3. Aphis was very numerous on both old and young wood in plot 4. The control was not so good as in plots 2 and 3, and there was very little difference, if any, from plot 1. No scorching of foliage was recorded. Aphis was very bad on both old and young wood in plots 5 and 6. There was apparently no difference in results from the two different strengths.

The trees in all the plots were again sprayed with the same preparations on 24th February. Examined three days after treatment the results were practically the same as recorded at the same period after the first spraying. Four weeks after treatment aphis was very numerous on trees in all the plots, especially those that had been treated with Pomsol, but plots 2 and 3 were better than the others.

From these results it is apparent that Blackleaf 40, applied alone or in conjunction with soap or lime-sulphur, is the most effective treatment, especially when used with soap. It is also apparent, however, that the control is very temporary. Aphis commenced to increase very rapidly the third week after treatment.

CONTROL OF SILVER-BLIGHT.

I. EXPERIMENT AT HASTINGS.

THE following report on an experiment for the control of silver-blight, conducted during the past year on mixed varieties of stone-fruit trees in the orchard of Mr. H. Paynter, St. George's Road, Hastings, is supplied by Mr. W. H. Rice, Orchard Instructor :—

The whole block was checked during February, 1919, and a detailed record taken of the condition of each tree. A selection of the orchard received in the autumn an application of lime at the rate of 1 ton to the acre. All treatments were duplicated on limed and unlimed land. The infected trees were classified according to amount of disease present, and divided into sections for treatment, in order to note the effect on the development of the disease, also the effect on the trees. An average of six trees in each lot were subjected respectively to the following treatments at bud-movement in early spring, 20/8/19, the quantities given being per tree in each case :—

1. Sulphate of ammonia, 2 lb. ; wood-ashes, 10 lb.
2. Sulphate of ammonia, 2 lb. ; wood-ashes, 10 lb. ; basic superphosphate, 2 lb.
3. Nitrate of soda, 2 lb. ; wood-ashes, 10 lb.
4. Nitrate of soda, 2 lb. ; wood-ashes, 10 lb. ; basic superphosphate, 21 lb.
5. Bonedust, 2 lb. ; wood-ashes, 10 lb.
6. Blood-and-bone, 2 lb. ; wood-ashes, 10 lb.
7. Orchard manure K.P. (B), 2 lb. ; wood-ashes, 10 lb.
8. Wood-ashes, 20 lb.

9. Bordeaux, 6–4–40, 6 gallons, applied to roots.
10. Same as 9, with sulphate of ammonia, 2 lb., in 8 gallons of water; K.P. (B), 2 lb.; wood-ashes, 10 lb.
11. Bluestone, 4 oz. to 4 gallons, applied to roots.
12. Same as 11, with sulphate of ammonia, 2 lb., in 8 gallons of water; K.P. (B), 2 lb.; wood-ashes, 10 lb.
13. Sulphate of potash, 2 lb.
14. Sulphate of potash, 2 lb., and K.P. (B), 2 lb.
15. Wood-ashes 10 lb.

With regard to treatments 9, 10, 11, and 12, the method adopted was to lay bare the roots over a circle equal to the spread of the frame of tree, and water with bordeaux or bluestone, as the case might be. In treatments 12 to 14 the roots were then lightly covered with soil, and after a few hours watered with the sulphate of ammonia dissolved in 8 gallons of water. The fertilizers and wood-ashes were mixed throughout the soil as it was being replaced.

Examination during February, 1920, showed the following results :—

Treatments 1 to 8 and 13 : No improvement in condition of any tree ; some decidedly worse.

Treatment 15 : Silver-blight had made progress.

Treatment 9–10 : Badly infected trees had gone off as though untreated. Slight infection, though general, had not assumed a bad form.

Treatments 11 and 12 : Trees in better general condition than when treated ; noticeably better in trees of light infection.

Acting on the appearance of the trees under treatment 11, a tree which was clean on examination in February, 1919, but had developed a light infection meanwhile, was subjected to treatment 11 during December, 1919. From an examination in February, 1920, this appears to have arrested the further development of the disease.

CONCLUSION.

Treatments 1 to 8 and 13 to 15 inclusive appear to be of no value in arresting the development of the disease, irrespective of limed or unlimed condition of the soil.

Treatments 9 and 10 (bordeaux, 6–4–40, applied to roots) appears of no value where trees are badly infected, but indicates probable value by retarding the development of a light infection. Similar conditions exist on limed and unlimed soil.

Treatments 11 and 12 (bluestone 1 oz. to 1 gallon at root) appears to be of value in retarding the development of the disease, particularly in cases of light infection. Results similar on limed and unlimed land.

Quite a number of trees recorded as clean in February, 1919, now show a light general infection. This is general on limed and unlimed area, and would suggest that lime has little or no effect in preventing the disease. Stimulative manures, while giving added vigour and tone to trees, appear to have no effect in retarding silver-blight.

It is recommended that experiments be continued next season to further determine the effect of root applications of bordeaux, 6–4–40, and bluestone, 1 oz. per gallon, using as a test basis trees which have developed infection only since 1919.

II. EXPERIMENTS AT ARATAKI.

Mr. T. E. Rodda, Manager of the Arataki Horticultural Station, furnishes the following report on experiments carried out at the station during the past season :—

The amount of the silver-blight infection was noted in the trees last autumn, and the treatments were applied during August. For the purposes of this report the different treatments will be signified by the letters "A," "B," and "C." These were as follows :—

"A" treatment : Bare the roots and water with bordeaux, 6–4–40, using at least 6 gallons, and then cover the roots.

"B" treatment : Same as "A," but after the bordeaux is applied cover the roots lightly with soil, and water a few hours later with sulphate of ammonia, 2 lb. to 8 gallons ; also apply a little mixed fertilizer and wood-ashes.

"C" treatment : Bare the roots and water with bluestone, 4 oz. to 4 gallons water.

The results of the treatments—noted in March—are as follows :—

Number of Trees.	Amount of Infection.	Treatment.	Date applied.	Results.
		Peaches.		
			August.	
1	Bad	B	13	No improvement. One limb died right back into main fork since treatment.
1	Bad	A	13	Two limbs have died since treatment. All new foliage badly silvered. (Cut back hard previous to treatment.)
1	Bad	B	13	Five main limbs have died back to main forks since treatment. An abundance of young growth started from lower regions of tree. Most of new foliage silvered.
1	Bad	C	13	Slightly improved. Still a trace of silver.
		Plums.		
1	Bad	B	27	Five main limbs have died since treatment. All foliage silvered. No improvement.
1	Bad	A	26	One main limb died since treatment. All foliage silvered. No improvement.
1	Slight	B	27	Portions of five main limbs have died since treatment. All foliage silvered. No improvement.
1	Slight	A	26	Infected limbs have died back. Balance of tree has made good growth. Much improved.

TREATMENT DURING GROWING-PERIOD.

As it was observed that the tree treated during August with bluestone solution was the only one showing any marked improvement it was decided to apply the treatment to several trees during the growing-period. The amount of the infection was noted and the

trees treated with the solution, the quantity being regulated according to the size of the tree.

The following gives an outline of the treatment and the results :—

Variety and Condition.	Treatment.	Quantity applied.	Date applied.	Results.
		Gallons.	November.	
Apricot. Bad infection	C	6	20	No improvement.
Apple. Bad infection	C	4	20	No improvement.
Nectarine. Slight infection	C	3	19	Old leaves still silvered. New leaves produced since treatment not showing silver. Improved.
Plum. Bad infection	C	6	19	Apparently no improvement. Leaves still silvered.
Peaches (2). Slight infection	C	6	19	Old foliage still badly silvered. Leaves produced since treatment free from silver. Improved.

It will be observed from the foregoing that the only trees that have shown any signs of improvement under this treatment are those that were but slightly infected previous to the application of the bluestone solution. To ascertain the full effect of the treatment it will be necessary to keep the trees under observation next spring, but present indications suggest that the experiments will be of little practical value.

A SOUTHLAND FODDER-CROP NOTE.

THE Fields Instructor, Invercargill (Mr. W. Alexander), forwards some particulars received from Messrs. Halliday Bros., of Kamahi, regarding a special fodder crop of oats, tares, and ryecorn, grown by them during the past season, under advice from the Department. The crop was originally intended for ensilage, but was subsequently allowed to ripen and harvested for cutting into chaff. "The land on which the crop was grown," says Mr. Alexander, "was originally in bush, but could on no account be called first-class land as it is understood in Southland. The crop was quite an object of interest during the growing and harvesting stages, it being in a field alongside the railway-line, and as an example of what may be done on some of our poorer lands the demonstration has been a very useful one." It may be mentioned that the class of fodder crop in question has so far been comparatively little grown by Southland farmers.

The notes supplied by Messrs. Halliday Bros. are as follows :—

"The area of 9 acres was ploughed from lea three years ago, and planted part in potatoes and part in turnips. The following season it was all in potatoes. The manure used was an ordinary potato-fertilizer at the rate of 7 cwt. per acre. While in the lea, twelve months before ploughing, the paddock had received 10 cwt. of carbonate of lime as a top-dressing.

"This past season we decided to try the mixture of oats, tares, and ryecorn for ensilage, and at the same time sow out in grass. The area was ploughed at the beginning of September, 9 in. to 10 in. deep, with a swamp-plough. It was then well cultivated, worked up, and rolled before sowing. The oats, &c., were drilled in on 5th November, at the rate of 1½ bushels oats, ½ bushel tares, and ¾ bushel ryecorn, with manure, 1 cwt. blood-and-bone, 1 cwt. super, and 1 cwt. carbonate of lime. After sowing, the ground was harrowed and rolled. Then in about a fortnight the grass-seed was sown behind the roller and covered in with a scrub harrow. The grass-seed mixture was 15 lb. cocksfoot, 4 lb. crested dogstail, 3 lb. while clover, 2 lb. cow-grass, 5 lb. timothy, 6 lb. perennial rye-rass, and 6 lb. Italian rye-grass. Finally a top-dressing of 2 cwt. super and 4 cwt. lime was given again with the roller.

HARVESTING THE FODDER CROP AT KAMAHI.

"The crop seemed to hang fire for a long time, and up till the New Year was no more than 12 in. to 15 in. high, but from then on it grew remarkably rapidly, the ryecorn especially reaching as high as 5 ft. by the end of January; the oats and tares were shorter respectively. A few weeks later at full growth we collected a few specimen roots of rye measuring over 6 ft. At this time we decided to let the crop ripen and cut it for chaff, instead of making ensilage. At the end of March we harvested, and it took twelve balls of twine for the 9 acres. We finished stacking on 10th April, having five good round stacks. We estimated each stack at a full 7 tons, so the yield per acre was just under 4 tons.*

"The tares grew rather patchily and were very thin in places, but on the whole showed a good sprinkling through the sheaves. The grass also was to some extent choked towards the centre of the field, but round the edges it was remarkably good, and doubtless will come away all right."

* This estimate has been realized in subsequent chaff-cutting.

WORK FOR THE COMING MONTH.

THE ORCHARD.

In opening the New Zealand Fruitgrowers' Conference at Wellington on 26th May the Hon. W. Nosworthy, Minister of Agriculture, gave an interesting *résumé* of the fruitgrowing industry, leading up to its present position and future possibilities. The following extract from the speech indicates its trend and importance to the industry:—

> "From the point of view of production fruitgrowing in New Zealand is no doubt quite a sound proposition, but, unfortunately, the matter does not end here. The proviso relative to reasonable market prices is the crux of the whole position. An industry cannot be said to have proved itself, nor can its importance to the community be fully assessed, until it has stabilized sufficiently to ensure to those engaged in it a reliable outlet and a reasonable return for the commodity produced. To my mind, however, the fruitgrowers' greatest hope still lies in the proper development of our local fresh-fruit markets, and there is every evidence that this can be done, possibly to the extent of utilizing at profitable prices the product of the whole of our existing orchards, provided a sufficiently efficient system of organization among growers and the trade generally is brought into existence. It is generally recognized that despite the heavy crops produced half of the people of this country get little or no fruit at all, while the major portion consume very much less than they would do were they able to readily procure supplies at a reasonable price. You must realize as well as I do that there must be something radically wrong with the present fruit-distribution system which allows such a state of affairs to exist; and, further, a system which demands the present high prices from the consumer whilst returning to the producer a meagre profit, and in some cases no profit at all, should not be tolerated a moment longer than necessity demands. What appears to me to be essential is a comprehensive organization scheme affecting the whole of the fruitgrowing areas of the Dominion, having for its object the ready disposal of the whole of our fruit crop at reasonable prices to the grower and consumer alike. In fact, I and my officers feel so strongly on the matter that I feel disposed to offer the services of the Department to assist you in establishing such an organization."

The Minister's suggestion was well received by the Conference, and steps are now being taken with a view to giving effect to it.

Following the Fruitgrowers' Conference a Varieties Conference was held. Five delegates—representing the fruitgrowers, nurserymen, and the Department respectively—constituted this conference. The principal business was to review the findings of the conference held in 1916, relative to the varieties of fruit-trees recommended for planting for the different markets, and to make adjustments and recommendations in

connection therewith which time and experience may have suggested. The proceedings and recommendations will be of considerable value to fruitgrowers and the future developments of the industry, and it is proposed to deal with the subject in the next issue of the *Journal*, also to publish lists of classes and varieties of fruit-trees recommended for planting and reworking.

—*J. A. Campbell, Assistant Director of the Horticulture Division.*

AUCKLAND.

During July, all fruit-trees being at their most dormant stage, oil sprayings may be applied at fullest strength. Growers who are troubled with mussel, olæ, maire, or other scales, and red spider, are advised to get their oilings on at 1–12 to 1–14 for pip-fruits, and 1–17 for stone-fruits, at the earliest opportunity.

As soon as the autumn growth has hardened on citrus trees, spraying with red oil at 1–40 should be carried out for control of scale and thrip. In cases where there is any setting of autumn fruits the oil may be preceded by bordeaux, 4–4–40, in which case three to four days should be allowed to elapse between the two applications or leaf-scald will result.

Pruning of stone-fruits should be put in hand with all earnestness. The attention of pruners is directed to the necessity for the removal of all diseased wood and mummified fruits from the trees at the time of pruning, remembering always to gather and burn the same when the work is completed.

Trees which are required to be replaced in the orchard should be removed, and the sites made ready for the new trees. If such trees are removed on account of root-fungus or silver-blight a dressing of 2 lb. sulphate of iron well incorporated with the soil around where the old tree stood is recommended. The preparation of the sites for new orchards should now be well advanced.

Apples and pears held in store in sheds should be gone through from time to time and diseased fruits removed. Maintain sufficient ventilation in the stores, but prevent strong draughts.

—*J. W. Collard, Orchard Instructor, Auckland.*

HAWKE'S BAY.

Where the land has been properly prepared planting may be carried out. Watch for suitable soil conditions for this work; if the soil is waterlogged and does not work freely planting should not be done.

Pruning, followed by winter spraying, will be the most important work at this season of the year. When stone-fruit trees have been pruned they should be sprayed with lime-sulphur, 1–15, or oil, 1–17, for scale insects, followed by bordeaux, 8–6–40, at the burst of bud. Japanese plums should be watched, as they often develop bud-movement towards the end of July. "Pocket" or "bladder" plum may be prevented by a timely application of bordeaux, 8–6–40. This disease was very prevalent throughout the district last spring, and no doubt the spores are resting in enormous numbers. Growers should therefore be prepared. The pruning of apples and pears should be pushed on, and the trees receive the dormant-season application of oil or lime-sulphur. For insect pests oil, 1–12, or lime-sulphur, 1–15 (where no woolly aphis is present), should give satisfactory results. Red mite will have to be dealt with later as it hatches. Oil, even at 1–6, cannot be relied upon for control of mite in the egg stages.

Where trees are to be grafted suitable scion wood of last season's growth should be selected and held over by laying the scions in the ground in a semi-dry position with all but the tips covered. Trees which are to be grafted should be lopped down to some little distance above the point where the grafts are to be inserted, making a clean fresh cut at the time this operation is performed. By heading back such trees now the main work of cleaning up can be done at the one time, while in practice less bleeding takes place at the time of grafting.

Citrus: Lemon brown-rot is favoured by the constant damp conditions prevailing at this season of the year. All small branches and laterals sweeping the ground should be cut away, and the trees sprayed with bordeaux, 4–3–40. Should the disease make its appearance sprinkle from 1 lb. to 2 lb. of pulverized sulphate of iron on the soil round the trees to the extent of the branch-cover, and lightly rake in. Scale insects may be dealt with by spraying with oil, 1–30, using a penetrating spray and covering the whole of the wood as well as the affected foliage.

—*W. H. Rice, Orchard Instructor, Hastings.*

NELSON.

The most important work in the orchard at this season is pruning. Where much of this has to be done it is not safe to delay, and the most should be made of the fine weather. Obtain the best talent possible for the work. If learners have to be employed see they are under the close supervision of a foreman. Past experience indicates that it is well worth while cleaning the pruning-tools often, especially when working among silver-blighted or cankered trees. A piece of cotton-waste saturated with a solution of lysol or formalin is useful for this purpose. Where grafting has to be done later remember to put aside a good supply of cuttings.

Where planting has to be done, complete the preparation of the land as soon as the weather will allow. Remember the prime objects are to clean the land of couch-grass and weeds, and obtain a good deep tilth. The work should be carried well up to the fences; to do this the hedges may want trimming back first. Once the trees are planted the opportunity for cleaning and deep cultivation is quickly discounted. When this preparation is completed, plant out the trees as soon as the land is sufficiently dry.

Orchard spraying is best deferred until next month.

Inspect the fruit in store at frequent intervals and give it all necessary attention; one can never be quite sure of what developments are going to take place.

A very important job just now is to make up a list of stores required for next season, and to secure them while one has the time to give the matter proper attention. To defer the matter until the last minute means a keen demand and high prices. Serious losses were incurred locally last season owing to an oversight of this fact. Until the transportation services are on a normal footing again the danger of trouble under this heading will be very great.

—W. C. Hyde, Orchard Instructor, Nelson.

MOTUEKA.

The directions given in last month's notes can be generally followed out this month, as the same class of work will be occupying the attention of the orchardist.

Pruning: Where heavy crops have been gathered and the bud-development promises another heavy crop next season it will be wise to thin out the crop by systematic disbudding. In many cases this season young trees—six and seven years old—have been noticed carrying far too heavy crops, the wood-growth being sacrificed for fruit. This practice, if continued, will seriously jeopardize the future of some promising orchards, a stunted, dwarfed appearance already making itself evident. Where these heavy crops have been borne on the poorer class of land it will be noticed that the development of fruit-buds is greater and the wood-growth less. On such trees disbudding is essential for the future welfare of the orchard. Disbudding should be carried out by reducing spurs or clusters of fruit-buds to two or three buds only. Always remove the weaker buds and leave good healthy buds to carry on. Those left should be as evenly spaced as possible. By doing this it will be found that both the vigour of the tree and the quality of the fruit will be considerably enhanced.

Closely followed, pruning becomes a wonderful nature-study. By assiduously watching the growth of the trees the student will find that the chief aim of nature is a continuation of the species by reproduction. The fruiting habit is always a sign of weakness. The weaker the tree the heavier the crop of fruit usually endowed by nature. While a tree is growing strong and healthy and reproducing itself by a succession of strong new wood growths little fruit will be borne, but immediately something happens to reduce the vigour of the tree—whether by insufficient pruning leaving more foliage and wood on the tree than the root-system can supply with nourishment, or by a system of root-pruning, or in any other way—so soon does nature set to work to reproduce itself by other means. The tree finding itself weakening, as if invested with reasoning-powers commences to reproduce itself by seed (the pips) to carry on the species. The edible portion surrounding these pips is, of course, the ultimate aim of production by the fruit-grower.

This fundamental knowledge should be one of the chief attributes of every pruner. Working with this fact in mind every endeavour should be made by judicious and systematic use of the pruning-tools to avoid either extreme, but chiefly, as the fruiting habit develops, the overproduction of fruit-buds. The majority of orchards in this district are still young—under ten years of age—and it is after carefully observing what is taking place and what may become a dangerous general practice that the foregoing words of caution are issued.

—W. T. Goodwin, Orchard Instructor, Motueka.

CANTERBURY.

As stated in my last month's notes, the pruning of stone-fruits should be well advanced and the pip-fruits commenced. It should hardly be necessary to go into details with regard to the pruning—in fact, it would take too long—but growers are advised to study their trees carefully, and, if not fully experienced in pruning, not to rush the work. A little extra time spent often means increased production another season. Any orchardists with young trees and wishing for information with regard to pruning should apply to the office of the Orchard Instructor, when full information will be given, and a visit made if necessary. When the pruning is finished clear up and burn all cuttings.

Those growers who have not attended to drainage should do so at once. It is time well spent.

There are still many orchards in the district that would be much better with shelter-belts planted round. This is the season to attend to the work. In the great majority of cases the poplar is the best tree to plant, as it does exceptionally well in Canterbury, but where the land is not suitable for the growing of poplars *Pinus insignis* is recommended. Providing the land is in good condition, planting can be carried out during the month.

—G. Stratford, Orchard Instructor, Christchurch.

OTAGO.

During July pruning will still be the main work in the orchard. During this operation growers will do well to look out for those trees that are affected by silver-blight. Cut out all affected parts and destroy at once, as the disseminating spores are bred on dying or decayed wood. All trees that have gone past redemption must now be rooted out and burnt immediately. All tools used in connection with these operations should be sterilized by swabbing with lysol or formalin. Cuts on trees should be dressed with a solution of corrosive sublimate, 1 to 1,000. Take care not to leave the mixture where children or animals can get at it, as it is poisonous, but it will not do any injury externally.

My attention has been drawn to the practice of some growers using flax-waste in lieu of wood-wool for apple-packing. This waste is sometimes very dusty, and where it is placed in direct contact with the apples makes them very dirty-looking. It is a good substitute for wood-wool, but growers are advised to place paper next to the fruit before applying the flax-waste.

August will be quite early enough to commence the oil spraying for insect pests. This subject will receive attention in the next month's notes.

—J. H. Thorp, Orchard Instructor, Dunedin.

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

THE HATCHING SEASON.

WHERE the heavier types of poultry are kept, such as Orpingtons, Plymouth Rocks, Wyandottes, &c., no time should now be lost in getting their eggs placed in the incubators or under broody hens. Early-hatched birds are invariably the more profitable. Indeed, if the chickens of these breeds are to produce during the next dear-egg season they should be hatched out by the end of August at the latest. For the ordinary poultry-keeper I would advise leaving the hatching of White Leghorns till August, but the parent birds should be mated now, in order that they may be well settled down before their eggs are required for reproduction purposes. Those who require only a small number of chickens, for renewing stock of the lighter breeds, will find in most cases that the best results will be obtained from pullets hatched towards the end of September.

The aim of the breeder should be to have his chickens growing as the days are lengthening. Usually chickens brought out during the hot

summer months are not only difficult to rear, but it is also generally found that they make poor progress when the days begin to shorten. Not only this but they frequently lay undersized eggs, and, not having the necessary vigour, are susceptible to all forms of disease. Therefore there should be no delay in making preparations to carry out hatching operations, which should not be delayed beyond the first weeks in October at the latest.

To those who use the natural mother for hatching and rearing their chicks I cannot emphasize too strongly the importance of keeping the hen quite free from vermin. It should be remembered that the most common cause of hens deserting their nests before the hatching-period is their being overrun with vermin. Before the hen is placed in the nest she should be dusted with carbolic powder, sulphur, or a good disinfectant powder, care being taken that it reaches the skin. Another important matter is to take every care to protect the hen and her young ones from accidents. Make the coop and run cat and rat proof. It will probably save much annoyance and loss later on. Further, when the chickens are hatched any board surrounding the nest should be removed, so that the chicks can get under the hen with ease. Scores of chicks are lost annually by getting out of the nest and being unable to return to it. Again, many a chicken has been drowned by jumping into a deep water-vessel. Minimize this risk by placing a brick or stone in such water-receptacles, or use shallower trays.

Many poultry-keepers will be using an incubator this season for the first time, and I would advise them not to rely entirely on theoretical knowledge. The best course is to consult a person of experience and obtain a practical demonstration as to the working of the machine. Then it would be well to test it with a few eggs before the practical work is entered upon. A simple test like this will prove most instructive, while it may save much subsequent loss and discouragement.

BREEDING-POINTS.

One breed is enough for most people to deal with if the flock is to be bred and managed to the best advantage. One breed may be studied successfully, whereas two may be studied indifferently.

Breeding from a pen of hens of various types is always a weak policy, even if they have proved to be good layers during their first year of production, as only a percentage of the progeny will be up to the desired standard. Careful selection of breeding-birds from a uniform type standpoint is essential if a heavy-laying flock is to be built up and maintained. Egg-performance alone will not achieve this end, as the best layer will not necessarily prove the best breeding-bird. In addition to breeding only from good layers the breeder should have an ideal type in his eye, and select birds conforming to this as near as possible. Even then it is not always possible to bring together birds which will nick with each other. The mating of birds demands great care on the part of the breeder, and the only way of bringing about an improvement in type is by using a female which is strong where the male is weak, or *vice versa*.

Such safe methods of eliminating weaknesses and strengthening desired characters cannot be left to nature, and, indeed, the remarkable development of all our races of domestic stock is mainly due to man's interference with nature to the extent of selecting the animals he mates to secure given ideal. For instance, if the hens are loose

in feather, one would select a male to mate with them with a tight and dense feather, rather than use a loose-feathered bird and thereby exaggerate what should be minimized. Few birds of the ideal laying and breeding type, which will have the desired influence in raising the standard, are to be found even in the best flocks in the country. Therefore the very greatest care should be taken in selecting the breeding-pens. Laying and breed type, desired size, and points indicative of constitutional vigour are the main things to aim at for the maintenance of a profitable flock. It is always a much safer policy to have too few birds in the breeding-pens than too many.

It is always advisable to select for the breeding-pen a hen of a slightly larger size than that which is usually considered the ideal weight for laying purposes alone. It should be remembered that it is easy to lose in weight of stock, but much harder to maintain the desired size without introducing coarseness into the type. As a rule the small birds will come readily enough without breeding for them. Breeding from small hens merely because they have proved heavy egg-producers is always a weak policy, but unfortunately there are too many breeders who fail to realize this fact.

Pullets should never be bred from if hens can be obtained. It is possible for a pullet to look a most desirable bird for breeding, but which would never be considered as a breeder at all after being subjected to the test of a season's laying. When pullets must be used they should be well-matured birds, hatched in the early spring of the previous year, and they should be mated with a vigorous cock bird in preference to a cockerel.

GRIT AND SHELLS.

Regarding the desirability of providing gravel-grit as well as oyster-shells, some birds certainly do well on sea-shells alone. As a preventative, however, of liver-trouble, and as a means of assisting digestion, sharp gravel-grit is always advisable, and in the case of the heavier breeds it is essential.

THE APIARY.

G. V. WESTBROOKE, Apiary Instructor.

DURING the cold winter months all manipulations of the bees should cease. At this period bees will be closely clustered in order to conserve heat, and it is not desirable to break the cluster, otherwise the bees are apt to become chilled.

As advised last month, it is necessary after wet weather to examine the mats in the hives, so as to ascertain that none are wet through leaky roofs. During cold weather extra mats should be supplied. Sacks or old wool-bales make excellent mats, but perhaps for winter old carpets are warmer. When cutting mats make sure that they do not overlap the edges of the hives, otherwise they will quickly become damp in rainy weather. It is better to cut them too small than too large.

STORES AND SUPPLY OF SUGAR.

Owing to the ample warning beekeepers have had in regard to the shortage of sugar there should be no danger of the bees dying of

starvation, for the careful apiarist would see that sufficient honey was left in the hives to ensure their safe wintering. In some districts where the season was bad and rapid increase was made it may be necessary to resort to feeding, but in any case this should have been done in the autumn. In some cases where there may be a doubt of sufficient stores in the hives beekeepers should at once procure sugar. This, as previously noted, may be procured from the New Zealand Honey-producers' Association, Stanley Street, Auckland, who have been appointed distributors by the controlling authorities. When applying, state the number of colonies that require feeding.

Beekeepers must not expect to get all white sugar, as so far the board of control has supplied only about one-third white and two-thirds light brown (No. 3 grade). This has been successfully fed in the Auckland Province during the late autumn without any ill effects, but in districts where bees do not get a cleansing flight it would perhaps be advisable to feed white sugar in urgent cases in the winter, reserving the lower grade for the early spring months.

None but registered beekeepers will be supplied with sugar. Any who have not registered their apiaries should therefore do so at once. It is compulsory for all persons owning one or more hives to register the same. Registration is free, and cards may be obtained at all the principal post-offices or any office of the Department of Agriculture. The fine for non-registration is £5.

MOVING BEES.

This is the best time of the year for moving bees from one location to another, for at this season they will be in a more or less dormant condition, and during cold weather there is but little danger of their smothering, as they are apt to do in summer. For short distances it will be found sufficient in most cases to secure the hive-body to the roof and bottom-board, and to tack some wire cloth across the entrance. Crate-staples will be found very useful for securing the hives to the cover and bottom-board. When, however, the bees are to be removed long distances too much care cannot be taken. Frames should be prevented from rocking in the hives during transit by wedging them firmly, first removing any heavy combs. Wire-cloth screens should also be used for long journeys, so as to give the bees as much ventilation as possible.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

In all forward districts it is now time to get busy with seed-sowing, planting, and general preparations for the season's work. The time for sowing in spring varies greatly, even in places not far distant from each other. The condition of the soil is largely affected by the depth of the water-table: the farther this is from the surface the warmer the soil is likely to be in spring. Local experience enables a person to tell when it will be safe to begin sowing seeds. It does not necessarily

follow that early sowing will give early crops; it may mean no crops at all if the soil is not in a fit state. A spell of fine weather may have made the soil fit for sowing, but the question is whether it will remain so if adverse weather supervenes. Bad drainage may render it water-logged, growth may be stopped, and the seedlings become overgrown with weeds. These are things that should be considered; it is useless to sow unless continuous growth is assured by a proper condition of soil.

Another thing to consider is what vegetables should be grown early. In the economy of a garden everything grown should be assigned a proper place. It is waste to have double the supply that is needed—waste both of time and of space. In a domestic garden the aim should be to provide a variety of vegetables in their proper season. No crop should occupy the ground longer than is necessary. If it does so it is at the expense of another crop, and usually at the sacrifice of quality. For instance, in a domestic garden the proper time for parsnips is during the winter months. Through the summer months there are peas, beans, &c. Parsnips sown at the end of October or early in November come into use by the end of March, and remain fit for use for at least five months—long enough for any one; they are comparatively young and do not become overgrown. But sow in August, as some do, and either they are used in place of something more seasonable or they stand wasting space and becoming overgrown and rank in flavour. Carrots, also, for winter use should not be sown till October at the earliest. A small sowing in early spring is sufficient, the larger sowing being made as stated, when the soil is in a condition to render thin sowing safe. This makes a saving of time at a busier season, and thin sowing saves labour in thinning and weeding. Celery, which I consider every one should grow, should also be treated as a winter vegetable. There can be plenty of easily grown lettuces and radishes during summer and autumn, as well as cucumbers, not to mention fresh fruits. Celery, being more troublesome to grow, should therefore be limited to a few rows for winter use, when it is most acceptable. Seed need not be sown till the last half of September, and the plants put out early in January.

Seasonable Work.

Cabbages and cauliflowers should be planted as soon as the plants raised from seed sown at the end of March or the beginning of April are ready. This is an important crop, and should have special attention. Lettuce should be planted from a sowing made at the same time as cabbage and cauliflower. Broad beans should be sown, if not already done. Sow also cabbage, lettuce, radish, and parsley.

During the first week in July the first of the regular sowings of peas should be made. Two varieties should be sown at the same time for a commencement—a true dwarf for first use, and a second early to succeed it. If sticks can be provided for the later kind, any of the varieties of the Dwarf Defiance type, that grow from 30 in. to 36 in. high, will do; if not, a dwarfer type, such as Sherwood or Stratagem, will be more suitable, for it is not profitable to grow tall-growing varieties if the haulm lies on the ground. Sow again two weeks after the first lot show through the ground; the first sowing is usually rather slow to break through. All after-sowings are made at intervals of a fortnight.

Onions should be sown if conditions are suitable; the earlier the crop is grown the less is to be feared from mildew, which rarely appears till February. Bulbs started early have by that time so far completed their growth that they suffer a minimum amount of injury from the pest. The soil should be well prepared and free from roots of perennial weeds. It should be made firm by rolling or other appropriate means. After being well firmed the surface should be worked to a fine tilth. When sowing thus early sufficient seeds should be used to render some thinning necessary, as there are risks of losses that are not encountered with late sowing. Another reason for using a little extra seed is that a very thin line does not readily break through a surface that may be battered down by rain.

Autumn-sown onions may be transplanted. The soil should have the same preparation as for seeding. Planting must be very shallow; only the roots should be buried. The quickest method is to make shallow drills with a marker. The sets can be laid on their side with the roots in the drill; then draw a little soil over them with the side of the boot and tread firm; the plants assume the upright when they begin to grow. Basic slag is a good fertilizer, using 4 cwt. per acre; or a mixture of superphosphate and bonedust, using about 2 oz. of the mixture per square yard, equal to about 2½ cwt. per acre. Give also sulphate of potash, 1 cwt. per acre, and if the soil is heavy the same amount of sulphate of ammonia. If the soil is light or medium the ammonia may be omitted and nitrate of soda given at a later period, directions for which will be given in a later issue. Wood-ashes and soot are valuable for onions. If a fair amount of these substances is available, give about 7 lb. per square rod. In such cases both potash and ammonia may be omitted.

Asparagus that has already been cut down should now have manure or fertilizers applied. In the case of beds stable manure should be given if possible. The manure should be in a somewhat fresh state; old, "fat" manure is not suitable. First, with a long-tined rake drag off all the soil that can be loosened from the bed; leave this soil in the alley by the side of the bed; then apply manure about 1 ft. deep. The soil is to remain until the end of August; the manure will then have settled down, and the soil should be placed on top of it. Where the asparagus is planted in lines on the flat a smaller dressing of manure may be given and left to be washed in by rain. Further treatment and other fertilizers will be mentioned later.

Old beds of summer rhubarb that have not been disturbed for several years may require lifting, and now is the time to do it. Lift the roots and pile them in any convenient place for a few weeks. The sign of the need of lifting is when the stools produce stalks of uneven quality, many of them too small to be acceptable. This means that parts of the crowns are worn out and should be cut out.

SMALL FRUITS.

Work outlined in last month's *Journal* should be completed as soon as possible. A few weeks' exposure to the weather after pruning is beneficial. All prunings should be cleared up and burned. The ashes may well be returned to the soil; they may not amount to much, but they will do some good, whereas if the prunings are dug in these breed fungus and create an unhealthy condition of soil. Fertilizers should

be applied in the course of the next few weeks. Most fertilisers are now available as planting will have been some time in the ground, and it is important that they be available as soon as the plants begin to grow. In most of that work in fruit-growing is done early in the season. Bone-dust has proved to be a good fertiliser for turnips and swedes. It is chiefly composed of lime and phosphoric acid, and is an efficient application. Failing bone-dust, superphosphate should be used, at the rate of 3 cwt. per acre. If there is a tendency to lime in the soil a dressing should be given two or three weeks before applying fertilisers of an acid type. Basic slag is non-acid. A minimum of 1 ton per acre of ground lime should be given, doubling that amount if lime has not been given for a few years.

TESTING FOR TUBERCULOSIS OF CATTLE IMPORTED INTO ARGENTINA.

New rules governing the testing for tuberculosis of cattle imported into the Argentine Republic under date 31st December, 1914, the main provisions being as follows:

Thirty days after the publication of the present decree animals of the bovine species which are imported into the Argentine Republic shall be submitted to the following tests:—

(a) Before leaving the port of shipment they shall be submitted to the ophthalmic reaction test in accordance with the general and special veterinary sanitary regulations. (b) Application of the ophthalmic reaction test for diagnosing tuberculosis. (c) Injection of tuberculin at the second test at least six days of the quarantine according to the instructions issued by the Director-General of Live-stock. (d) Animals which obtain show reaction to either of the two above-mentioned tests must be slaughtered. (e) Whether suspicious or positive the ophthalmic test is understood to mean those cases in which the animals have a temperature, ascertained at the intervals just as the tuberculin test is applied, of 1° C. (1.8° F.) or more above the normal. (f) Animals in which the reaction is not sufficiently clear on which to form an opinion shall be subjected to further quarantine, which shall last for the time necessary to make such new tests as the Director-General of Live-stock may decide upon. (g) The owners or their representatives, of animals which have been slaughtered on account of showing reaction to the tuberculin test shall not be permitted to view the autopsy, but a detailed report thereon shall be drawn up in each case.

[illegible] Shows.—The winter show at the Otahuhu A. and P. Association will be held on 16th and 17th July at Otahuhu.

Owners Registration.—Owners of bees who have not hitherto registered may obtain registration cards from all main post-offices as well as the principal offices of the Department of Agriculture.

Unclaimed Journal Subscriptions.—The following amounts have been received from subscribers whose [illegible] No. 1 Vol. [illegible] is out of print: postal note No. 282202 issued at Auckland, 2s 3d; 2s. 6d. in stamps attached. Senders should communicate with the Publisher.

Importation of Animals Act.—The regulations under the Stock Act gazetted on 25th February, 1915, permitting the importation of animals into New Zealand from the United Kingdom and Australia under certain conditions regarding sterilisation, have been revoked by an Order in Council dated 20th May, 1915.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

RED SPIDER AND STRAWBERRY-BEDS.

J. H. NEWMAN WATT, Paremoremo:—

I should esteem it a favour if you would advise me as to the best method of exterminating or controlling red spider on strawberry-beds. This pest is destroying the plants and runners on some of the beds in this district. Burning the plants has been tried, but the spider is still in evidence on the new leaves. As the spider is mostly on the under-side of the leaf, it is almost impossible to get at it with the spray-pump. Would it be advisable to plough in the old beds and replant; and would it be safe to plant new ground contiguous to the infected area? Is the spider a menace to other plant-life?

The Horticulture Division:—

The red spider affects a very large number of plants; very few, in fact, are exempt from its attacks when conditions are favourable for the insect. It is an annual pest of fruit-trees, being most troublesome during dry summers. These insects sometimes do great damage in glasshouses, nearly all under-glass plants being liable to attack. Cucumber-plants are at times totally destroyed by them, this occurring because the nature of the foliage will not allow of efficient spraying. When greenhouse plants are supplied with a sufficient amount of root moisture, and the atmosphere is not allowed to become dry, there are no red-spider attacks. This is proof that dry conditions and a high temperature are necessary to bring about a bad attack. The atmosphere in the open cannot be controlled, and dry conditions are sure to favour the insects. In the case of fruit-trees and other plants that have fairly firm foliage, and that can be reached by a spray, control is fairly easy by the use of lime-sulphur. It appears to be practically impossible to spray strawberries in an efficient manner. The fact that they are badly attacked shows that the position or soil is unsuitable. Probably the soil is too dry, and their culture may have to be abandoned. Even if the whole of the insects and the eggs that are now on the plants were destroyed that would not secure future immunity. Thorough irrigation or heavy mulching might effect an improvement.

FEEDING MANGOLDS TO COWS.

"WAIKATO FARMER," Cambridge:—

Kindly inform me what amount of mangolds could be safely fed to cows on grass pastures, without hay, and whether it would be wise to feed the mangolds while the cows are on new grass. The roots are intended for the cows after calving.

The Live-stock Division:—

It is somewhat difficult to say what quantity of mangolds could be safely fed to cows on grass pastures, so much depending on the nature of the latter. On old rough feed a moderate daily allowance of mangolds would prove beneficial, whereas on ordinary grass paddocks if mangolds are fed to the cows for any length of time without hay digestive troubles are sure to follow. Moreover, if mangolds are fed to cows in the paddock all the animals do not get the same amount, some animals being greedy feeders while others scarcely touch them. As to mangolds being fed while cows are on new grass, you will probably find, under such condition, that the cows will not eat the mangolds.

INTERPOLLINATION FOR DELICIOUS APPLE-TREES.

"APPLE," Herne Bay, Auckland :—

I want to plant a block of Delicious apple-trees with the minimum number of another kind required to give cross-fertilization. What variety is recommended for this purpose, and what percentage would be required ?

The Horticulture Division :—

The following varieties flower at the same time as Delicious and are suitable for planting in the Auckland District : Jonathan, Summer Golden Pippin, White Winter Pearmain, Cox's Orange Pippin, Dunn's, Gravenstein, Rome Beauty, Scarlet Pearmain, and Cleopatra. If it is intended to plant only one variety in addition to Delicious, Summer Golden Pearmain is recommended, this variety being a good grower and regular cropper. One row of the interpollinator in four is considered sufficient.

FEED FOR YOUNG HORSES.

"PACK-TRAIN," Clinton :—

Kindly inform me what is the best kind of crushed grain, beans, maize, peas, &c., to add to oaten-sheaf chaff fed to a young horse in order that he may develop his body to the greatest possible extent before he finishes growing.

The Live-stock Division :—

For feeding a young horse there is nothing much better than good oaten chaff with a few pounds of crushed oats, supplemented by ¼ lb. to ½ lb. of treacle dissolved in water and mixed with the evening feed. A few swede turnips are also advisable. Crushed beans, maize, and peas are very good for horses in hard work, but in young horses they must be used with considerable discretion.

FRUITING OF SEEDLING LEMON-TREES.

J. D., Wanganui :—

I have several lemon-trees six years old, which were grown from seed. They are fine healthy-looking trees, but have never fruited. Are they likely to do so ?

The Horticulture Division :—

Seedling trees are always a long time coming into fruit, this being the case with all fruit-trees. There is also a good deal of uncertainty as to the quality of fruit seedlings will produce. The method of raising fruit-trees from seeds has only one really practical adaptation—namely, for getting new varieties. Usually hundreds, sometimes thousands, of seedlings are rejected to one kept. Hybridists always take a bud or scion from the seedling and work it on to a stock as the quickest way to get fruit. Your lemon-trees can probably be made to fruit by checking the roots. At a distance of about 3 ft. from the bole of the tree dig a trench deep enough to sever all the roots. Each large root cut by the spade should be recut with a sharp knife. Begin each cut on the under-side of the root, and cut outward and upward so as to cut at an angle of about 45 degrees, then fill back the soil and tread it firm.

BRANDING CATTLE.

A. H. HUNT, Dairy Flat :—

Where is the correct place to brand a beast (steer, &c.), and what are the best materials to use ?

The Live-stock Division :—

We consider the best method of marking cattle running on securely fenced country is to earmark them, as by this means the eventual depreciation in the value of the hide due to body-branding is avoided. If it is deemed necessary to hide-brand cattle, it is best done on the neck, in order to avoid as much as

possible the damage to the hides. Cattle are usually branded on the rump, the reason being that that part offers a convenient and good surface for branding, and that the mark in that position can be readily detected. In our opinion the fire brand is still the best method of hide-branding.

HEIFERS FAILING TO GET IN CALF.

"DAIRY-FARMER," Whareora :—

Will you kindly give advice as to the treatment for two young heifers which fail to get in calf? I have tried sublimate tablets and lysol without success, washing both bull and heifers. The bull is a strong young Jersey which has got a number of cows in calf, but the two young heifers running with him keep on repeating.

The Live-stock Division :—

The treatment for young heifers failing to get in calf is somewhat difficult, as there are various reasons why an animal may fail to conceive. In your case, however, we are inclined to the opinion that you have been using the sublimate tabloids too freely, and by doing so have set up a certain irritation which is hindering instead of assisting the end in view. You are advised to keep the animals away from the bull for two or three months, at the end of which time they should be washed out with a solution of bicarbonate of soda and water—one tablespoonful of the soda to a gallon of warm water—just before being put to the bull.

DOG WITH SKIN TROUBLE.

J. C. SCOTT, Carnarvon :—

I have a young sheep-dog suffering from a skin-disease. The head and legs are covered with a mass of dry, scaly, small sores. Please advise me as to the best cure for the disease.

The Live-stock Division :—

The trouble is probably a condition not unusual in young dogs, resembling eczema, and most often produced by improper feeding. The following treatment is recommended: Wash the parts thoroughly, and dry. Apply daily a sufficient quantity of white precipitate ointment (which may be procured from any chemist), and give internally 2 drops of liquor arsenicalis in a little water two or three times daily. Wash the sores every third day.

FATTENING OF PIGS.

T. H. L., Hastings :—

Can you please inform me whether pigs fattened on lucerne, pumpkins, or mangolds are suitable for pork or bacon, or is it necessary to supplement their feed with grain? If grain is required in addition to the other feeds, what quantity should be given.

The Live-stock Division :—

Pigs that have fattened on lucerne, pumpkins, or mangolds are not suitable for pork or bacon until they have been finished off on some grain ration. It is a good method to supplement the forage crop with a 1- to 3-per-cent. ration of maize, barley, wheat, oats, or rye, according to the age and size of pigs, some months before they reach the killing size. By doing so an increased daily gain in weight is obtained, and at the same time a much better quality of flesh provided. A fortnight on a full grain ration will complete the feeding, and the pigs should then kill in a highly finished condition.

NOTE.—An answer cannot be given to inquiry by "Arees" (instruction in beekeeping) unless name and address are furnished.

SALE OF BEES FROM FIRE-BLIGHT AREA.

In view of the fact that the Department's Tauranga and Ruakura apiaries are within the fire-blight infected area, no bees will be distributed from those stations during next season, 1920-21. No orders will therefore be taken until further notice. This decision, of course, mainly affects the sale of queen bees.

LAND FOR RETURNED SOLDIERS.

During the month of May an area of 131,796 acres, subdivided into 155 holdings, was thrown open by the Lands Department for selection. Of this, 93,900 acres was for discharged soldiers only, and included one pastoral run of 28,016 acres and three small grazing-runs of 4,760 acres, the balance of the land opened being suitable for mixed farming, cropping, dairying, &c.

During the month of June, 101,448 acres will be available for selection, of which 98,592 acres are for selection by discharged soldiers only. This latter includes one pastoral run of 21,200 acres and six small grazing-runs of 34,750 acres, the balance being suitable for mixed farming, dairying, &c., and being subdivided into 105 holdings.

Early in July, twenty sections, suitable for dairying, situated on the Hauraki Plains and comprising 1,775 acres, will be available for selection; also an area of 10,020 acres subdivided into fifteen holdings, situated in Pakaumanu Survey District, Auckland Land District. Selection in both cases is confined to discharged soldiers.

Large areas of Crown lands are under survey, and although at present it is not possible to fix a date for their opening they will be offered at earliest opportunity.

REGISTRATIONS OF FACTORIES, ETC., UNDER THE DAIRY INDUSTRY ACT, AT 30th APRIL, 1920.

District.	Creameries (Butter).	Factories (Cheese).	Private Dairies.		Packing-houses (Milled Butter).	Totals.
			Butter.	Cheese.		
Auckland	53	51	..	..	4	108
Taranaki	26	116	6	..	3	151
Wellington ..	20	70	1	..	12	103
Hawke's Bay ..	10	23	..	..	..	33
Nelson	7	5	..	..	6	18
Marlborough ..	4	7	..	..	..	11
Westland	8	4	..	..	..	12
Canterbury ..	12	16	..	..	..	28
Otago and Southland	13	92	..	..	3	108
Totals, 1920 ..	153	384	7	..	28	572
Totals, 1919 ..	159	388	18	18	29	612

Note.—Five dried-milk factories and one condensed-milk factory were also operating at 30th April. One dried-milk factory has started since that date.